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*A Report to the*
*City Planning Commission on a*

# TRANSPORTATION PLAN FOR SAN FRANCISCO

*NOVEMBER 1948*

*De Leuw Cather and Company*
*Consulting Engineers*

*Ladislas Segoe and Associates*
*Consulting City Planners*

A Report to the

City Planning Commission on a

# TRANSPORTATION PLAN FOR SAN FRANCISCO

November 1948

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# FOREWORD: THE PURPOSE OF THIS REPORT

Transportation, considered in its broad sense, is an acute municipal problem in San Francisco. That is obvious to residents of the City and of the Bay Area, and is apparent to even the most casual observer. More persons talk about the problem, more news and editorial space is devoted to it, more persons' daily lives are affected by it, and more city departments are directly concerned with one or another phase of it, than any other single problem confronting the government of San Francisco.

## Transportation is a Primary Problem

The citizens of San Francisco at the 1947 general election authorized an expenditure of $50,050,000 for a number of urgently needed transportation improvements. Several times that sum will have to be expended before transportation ceases to be a major problem. At stake is the preservation of values measured in far greater terms than the funds to be expended: indeed the very survival of San Francisco as a healthful and efficiently functioning city is dependent upon resolving the not-so-slow strangulation which a deficient transportation system is inflicting upon the City.

Attempts to solve the problem by isolated or limited corrective or regulatory measures have proven ineffective. It has come to be recognized generally that the only attack that can break the stranglehold which the transportation problem has on the life of San Francisco is one that is comprehensive, far-reaching, and broadly conceived in terms of twentieth-century urban needs.

This was recognized by the City Planning Commission in 1946 when it recommended a coordinated approach to the problem by all of the city departments concerned with any phase of transportation. In following this recommendation the Technical Committee of the Departments of City Planning, Public Works, Public Utilities, and Police reached agreement on a plan and program for immediate improvements which was incorporated in a report on "Traffic, Transit, and Thoroughfare Improvements in San Francisco", dated March 1947. The recommendations contained in that report formed the basis of the bond issues approved by the electorate in November 1947.

## How This Report Came to be Prepared

In its March 1947 report the Technical Committee stated that "no one familiar with the transportation problems which face this city... ....can fail to realize that the (recommended) projects as a group, although important and obviously of high priority as to need, do not constitute by any means a complete solution. It has been taken for granted that more, much more, remains to be done if San Francisco is to go forward." The Technical Committee endorsed the recommendation, made earlier by the City Planning Commission, that the transportation section of the Master Plan be developed in full by the four city departments represented on the Technical Committee. As a consequence the City Planning Commission included in its budget request for the fiscal year 1947-1948 a sum of $200,000 for this purpose. In May 1947 the Board of Supervisors approved the appropriation of this sum.

Technical Help Sought

The Technical Committee had pointed out in its report that "it will be necessary to employ special consultants so that the City may have expert advice in certain highly specialized fields. In so doing it is desirable to avoid the mistake, frequently made here and elsewhere in the past, of employing such men to make independent investigations, and to receive their fee for a report which is detached from the realities of the problems as understood by the departments concerned. Such reports are all too often, and perhaps rightly, disregarded as instruments of official policy".

The City Planning Commission, after careful consideration, in October 1947 engaged the firm of De Leuw, Cather and Company of Chicago, internationally experienced in the fields of traffic and transportation engineering, and Ladislas Segoe, City Planning Consultant, to work with the staffs of the local departments in the development of a comprehensive transportation plan. Each of the consultants engaged provided a full-time resident representative in San Francisco, and De Leuw, Cather and Company, in addition, brought in several specialists during different periods of the planning job.

A special office was established for the study in the building of the Department of City Planning at 100 Larkin Street, and staff help was provided during the various stages of the study by the Public Utilities Commission, the Police Commission, the Department of Public Works, and the Department of City Planning. In addition, a supplementary staff of temporary personnel was employed during the course of the study.

Although the technical work of the consultants' staff has been completed, the two principal consultants will be available for an additional six months to advise the departments and the City Planning Commission in the final formulation of the transportation plan.

Basis for Master Plan

The report submitted herewith by the consultants is the result of the year of intensive study given to the transportation problem in San Francisco. As a report to the City Planning Commission, developed with the full help and cooperation of the Departments of Public Works, Public Utilities, and Police, it will serve as the basis for the expansion of the transportation section of the Master Plan which will be prepared, considered, and adopted by the City Planning Commission during the coming year.

Thus, with this report San Francisco now has within its grasp a comprehensive plan for transportation and a guide for necessary action which effectively can check the forces of disintegration fostered by an outdated and inadequate system of transportation facilities. With unity of purpose and the will to achieve, San Francisco can start on the road through its second century with positive steps toward an obtainable goal.

Ernest Torregano

Ernest Torregano
Acting President
City Planning Commission

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November 19, 1948

City Planning Commission of the
City and County of San Francisco,
100 Larkin Street,
San Francisco 2, California

Gentlemen:

We have completed and take pleasure in transmitting herewith our joint report on A TRANSPORTATION PLAN FOR SAN FRANCISCO pursuant to our contract with your Commission of October 17, 1947. This planning assignment has been based on the most comprehensive and thorough survey data ever available in this area.

The report presents a system of trafficways within the city; a comprehensive and balanced system of city-wide public transit; terminal facilities for interregional and suburban transit routes; recommendations for improved functional use of the city streets through modernized traffic control; and finally, a plan and program for off-street parking facilities. The studies have been projected to the year 1970, at which date it is estimated that San Francisco will have attained its nearly full population growth.

This undertaking has been carried on under the general direction of a committee composed of representatives of the Department of Public Works, the Public Utilities Commission, the Police Commission and the City Planning Commission. An efficient staff, specially created for the purpose, has performed most of the work involved in the completion of these plans under our direction. In addition, members of the technical staffs of all four city departments have been made available for special assignments and studies almost constantly during the past year.

We are pleased to acknowledge the whole-hearted cooperation of all of the city departments, without which it would have been impossible to complete studies of the breadth and detail involved within the time allotted. We also acknowledge the cooperation of Colonel John Skeggs, Assistant Engineer of the California Division of Highways, Mr. Ralph Tudor, Chief of the Bay Toll Crossings Division of the California Department of Public Works and the members of their staffs who have cooperated in making data from the Bay Area Metropolitan Traffic Survey available as requested. Acknowledgment is also made of valuable data and assistance of the Federal Public Roads Administration,

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## SUMMARY OF REPORT

The report contains a description of the various features of San Francisco and the Bay Area pertinent to the preparation of transportation plans, including population, physiography, the pattern and characteristics of physical and economic development and the San Francisco land use plan. It is estimated that the population of the metropolitan district will increase from 2,600,000, the present figure to a total of approximately 3,600,000 by the year 1970. San Francisco itself, it is estimated, will continue to increase in population but at a declining rate so that about the year 1970 it is expected to reach a total figure of 875,000, at which time virtually all of the available residential area within the city will be occupied.

The Bay Area Metropolitan Traffic Survey completed by the State Division of Highways in cooperation with the Public Roads Administration provided an exceptionally sound base for projecting transportation plans. These data were supplemented by special counts and surveys, including origins and destinations of suburban passengers in San Francisco, a cordon count of traffic entering the metropolitan traffic district and various parking and transit surveys.

### Trafficways

A substantial portion of the voluminous data analyzed were utilized to develop a pattern of freeways in San Francisco. These high-type trunk line highways, allowing free and safe flow of great volumes of vehicles on a right-of-way protected against roadside development, with cross streets either blocked off or taken over or under the freeway on overpasses or underpasses, are planned as the backbone of San Francisco's highway development. Special provisions were incorporatin the 1947 Burns-Collier Highway Act to provide for their financing.

The freeways planned for San Francisco will accommodate the three predominating flows of traffic to the central district; from the west by the Panhandle Freeway and its extensions; from the southwest by the Mission Freeway; and from the south by the Bayshore Freeway now under construction. These three great thoroughfares will be interconnected by the Central Freeway planned near the south and west boundaries of the Metropolitan Traffic District which will function as a distributor of the heavy traffic concentrations from the radial freeways.

The Marginal Freeway is proposed to provide a direct route to the eastern fringe of the downtown district from the proposed Southern Bay Crossing. The Alemany Freeway is intended to afford a direct connection for vehicles from the Southern Bay Crossing destined to the south and southwest over the Bayshore or Mission Freeways.

Two extensions of the Panhandle Freeway are proposed. The Richmond Freeway will skirt the north edge of Golden Gate Park, providing a direct connection into the Park Presidio Expressway and to the Golden Gate Bridge. The Sunset Freeway will skirt the southern edge of the park serving Kezar Stadium and extending to 19th Avenue, providing excellent highway facilities between the Sunset District and the areas west of the Twin Peaks and the downtown district.

Estimates of traffic which would be accommodated by this pattern of freeways indicate that substantial volumes of the traffic now handled on local streets will be diverted to these off-grade roadways. These show that almost full use of most of the Bayshore, Mission, Panhandle and Central Freeways will be realized within the period covered by the transportation plans. While traffic on other freeways will not absorb all of the capacity of these facilities, economic studies indicate that the $90,000,000 cost of the complete pattern will be more than justified by savings in costs and time to the motorist.

The recommended trafficways plan also includes a balanced system of expressways and major thoroughfares which it was found should be completed by the year 1970. No pattern of freeways can be expected to carry all through traffic in any city. Some sections too far removed from freeways will necessarily continue to depend on thoroughfares of more or less the usual types. During the past few years, a number of noteworthy improvements to the major street system have been completed. However, numerous additional improvements are required for a thoroughly coordinated and balanced system of thoroughfares adequate to meet San Francisco's needs during the foreseeable future. These projects, grouped into four categories - expressways, major thoroughfares, secondary thoroughfares and parkways - are included in the trafficways plan. This trafficways plan has been developed after full consideration of all pertinent factors such as the pattern of existing and proposed neighborhoods and communities, existing major traffic routes, topographical features, traffic origins and destinations, existing and proposed land uses and comparative costs. The estimated cost of the entire trafficways program is summarized as follows:

| | |
|---|---|
| Mission Freeway | $ 26,960,000 |
| Panhandle Freeway | 9,480,000 |
| Sunset Freeway | 3,260,000 |
| Richmond Freeway | 3,660,000 |
| Central Freeway | 31,710,000 |
| Alemany Freeway | 14,930,000 |
| Expressway and Major Thoroughfare Improvements | 21,000,000 |
| Total | $111,000,000 |

While the total figure is large, it is well within the reach of the various agencies involved. A stage construction program is suggested providing for accomplishment of the complete plan during three seven-year periods, with expenditures of approximately $38,600,000, $37,100,000 and $35,300,000, or an average annual outlay over the twenty-one year period of approximately $5,300,000.

Transit Plan

In an interim report dated March 5, 1948, a short-range plan was submitted for modernization of the municipal transit system and related matters, including improved traffic control along downtown Market Street, and for additional one-way street operation in the Metropolitan Traffic District. Recommendations were made covering the pattern and character of public transit modernization to provide a basis on which to project long-range plans. An effort was made to provide the necessary and vital improvements to public transit through the operation of

modern equipment over an improved local street system. It was hoped that adequate and convenient transit could be supplied without any heavy capital outlay for subways. Our studies proved, however, that certain subways and other grade separated structures ultimately will be required.

A subway in Market Street is recommended as the key to a sound long-range transit plan. This project, involving a total cost of $52,500,000, is proposed to be built in stages. The first, extending from a downtown terminal loop to Van Ness Avenue is estimated to cost $26,500,000. In addition to the rapid transit lines to be operated through the Twin Peaks Tunnel, this section of the Market Street subway will also serve as a terminal for the projected Mission rapid transit route, to be constructed as a part of the proposed Mission Freeway.

Rapid transit bus operation is proposed along the Bayshore Freeway, the Panhandle, the Richmond and the Sunset Freeways, and ultimately along the Geary Street expressway. Growing traffic to the central business district will ultimately require off-street terminal facilities to keep the number of trolley buses and gas buses operated on the streets in the central district to workable levels.

Such facilities are planned in a subway along Post Street, with special connections to the Central Freeway and Geary Street near Van Ness Avenue and to an off-street bus terminal on the south side of Second Street. Rapid transit service in the form of express bus operation from the Sunset and Richmond Freeways and from the Geary Expressway would be operated through this second downtown subway. The system of routes recommended will provide for rapid transit service on a well distributed pattern of routes radiating from the downtown district. Estimated capital outlays required to complete the program are as follows:

| | | |
|---|---|---|
| Market Street Subway | | |
| Downtown terminal to Van Ness Avenue | $26,500,000 | |
| Van Ness Avenue to Twin Peaks Tunnel | 14,000,000 | |
| West Portal to Eucalyptus Drive | 12,000,000 | |
| | | $52,500,000 |
| Mission Rapid Transit | | |
| Subway connection from Market Street to the freeway near 16th Street | $ 7,000,000 | |
| Additional cost of right-of-way and construction required for rail rapid transit in the Mission Freeway | 4,000,000 | |
| | | 11,000,000 |
| Express Bus Facilities | | |
| Additional cost of facilities required for express bus operation on the Central, Panhandle, Richmond and Sunset Freeways | | 600,000 |
| Post Street Subway | | 18,500,000 |
| Total Cost of Entire Rapid Transit Program | | $82,600,000 |

This program will require an average outlay of approximately $4,000,000 per annum during the next twenty-one years. It is recommended that the first section of the Market Street subway be undertaken as soon as financing can be arranged. Rapid transit facilities recommended for the various freeways should be financed and completed as the freeway construction program progresses. The timing of the second and third sections of the Market Street subway and the Post Street subway may be determined by future growth in traffic requirements.

Among the principal benefits of the rapid transit system will be the striking increases in speeds and reductions in overall travel time. Running time to many portions of the city will be cut in half. Improved speeds and more convenient service will increase patronage and gross revenues. At the same time, operating costs will be reduced through economies from high speed operation. The proposed subways will reduce substantially the number of transit vehicles operating on the downtown streets, bringing improvement in traffic conditions. Convenient and fast transit service may be expected to attract a considerable number of persons who otherwise would travel by automobile, thereby minimizing traffic and the demand for parking space in the downtown district.

San Francisco Transportation Terminals

Suburban service between most of the East Bay Area and San Francisco is rendered by the Key System which operates trains and buses over the lower deck of the Bay Bridge. During recent years this company has operated motor buses in increasing numbers. All trains and buses are through-routed to the San Francisco terminal from various centers in the East Bay Area.

Railroad suburban service to the southern peninsula communities is operated by the Southern Pacific Company from a terminal at Third and Townsend Streets. These services are supplemented by suburban bus operations from various parts of the metropolitan area into two terminals in downtown San Francisco.

The Joint Army-Navy Board, in its recent report, recommended a second Bay Crossing in a location near Army Street on the San Francisco side. The Board also recommended an additional and entirely separate tunnel for mass transportation, connected with an elaborate and costly system of transportation subways, both on the East Bay and on the San Francisco sides. The State Division of Highways, after first recommending an additional parallel bridge close to the existing Bay Bridge, subsequently modified its policy to plan two additional crossings, one in the parallel location first proposed and one in the southern location, proposed by the Joint Board.

Estimates of transbay public transit traffic to the year 1970 show that peak hour traffic can be readily handled by trains operated on the existing two-track railroad on the Bay Bridge. No additional transbay rapid transit facilities are required.

Estimates of traffic which could be attracted to first class rapid transit services in and through the East Bay cities show that heaviest traffic generated on any one route would be well within the

capacity of express buses operating on the network of proposed freeways. Such traffic would be far below that which would be required to support the enormous investment in subways. For these reasons, express and local feeder bus lines are suggested, serving all portions of the East Bay Area operating to a terminal on the east approach of the existing bridge where convenient transfer would be afforded to trains operated on a frequency of forty trains per hour.

New modern high speed equipment and improved signals are recommended for the seven-mile trip over the Bay Bridge and its approaches. No change in location of the Bay Bridge Terminal in San Francisco is suggested, but vastly improved facilities would be afforded for the distribution of transbay passengers through connections to the Market Street and Post Street subways.

No change in location of the Southern Pacific terminal at Third and Townsend Streets is recommended but a new off-street bus terminal is proposed to provide convenient transfer of passengers to buses for delivery to San Francisco destinations.

Estimates of future transbay traffic indicate that it will reach a total of 115,000 vehicles on a normal weekday by the year 1970. Upwards of 25 per cent of this total would be diverted to a new crossing in the Army Street location. After full consideration of the effect of building a second crossing in the alternate locations under study - on the downtown street system in San Francisco; the overall development of the metropolitan area; the navigation hazards involved in the parallel bridge; and finally the fundamental need for dispersion from a military viewpoint - we concur in numerous previous findings and recommend the second crossing in the Army Street location.

Improved Traffic Control

Improvements in the functional use of the streets are recommended including: one-way street operation; through streets; modern traffic signals; traffic organization and miscellaneous related improvements. Improved traffic control is planned for downtown Market Street, including channelization of intersections and modern signals.

A city-wide plan of through street operation is recommended for the more efficient movement of traffic on heavily traveled thoroughfares and to improve safety. Special studies were made of especially hazardous street intersections and a program for accident reduction recommended, illustrated by detailed treatment proposed for six most hazardous intersections in San Francisco.

Parking Program

Analysis of all survey data, supplemented by inventory of existing facilities and their use, provided the basis for determining present and future demand for parking facilities. These surveys determined an extremely high incidence of all day parking and a striking lack of enforcement of regulations. Present demand was established at 5,740 additional car stalls, and 1970 requirements at an additional 14,000

Studies of economic factors proved that these facilities could be furnished in multiple level above-ground garages in satisfactory locations in the central district at an estimated cost of $8,000,000 for the present program and $20,000,000 additional during the next twenty years. It is recommended that existing legislation be utilized in implementing this program under the administration of one of the existing city departments. Certain modifications in present legislation are desirable or, if preferred, new legislation could be sought to provide for a new municipal parking authority.

## A COORDINATED PLAN FOR DOWNTOWN SAN FRANCISCO

The focal point of all transportation facilities is Downtown San Francisco where all major travel routes come together to serve the business, financial, cultural and amusement center of the metropolis. This is an area of great concentration, of conflicts between different forms of transportation, and competition for street space. No amount of separate, unrelated planning of subways, freeways, one-way streets, parking facilities, and the like can be expected to produce an orderly and efficient circulation system in this area. Nor would the combined results of such piecemeal planning be likely to contribute much to the conservation of values and sound future development of the Central Business District.

The Downtown Problem calls for fully integrated and properly balanced proposals in accordance with sound basic principles and policies. One of these is that the transportation facilities as a whole must be so designed and arranged that they will help the Business District to retain and enhance its drawing power, and mold its growth along logical and desirable lines. Through close coordination between the Transportation and Land Use Planning processes, it has been possible to give full recognition to such an objective.

The Department of City Planning has provided basic information on the present composition and the probable and desirable future growth of the Central Business District which has served as a guide for the transportation plans. The main component elements of this area are the shopping district and the financial and office districts. Professional office buildings, hotels, theatres, clubs, cafes, and other amusements also constitute important features. The entire area is confined between Nob Hill on the north and the wholesale district along Mission Street. With the bay at one end and most of the population and purchasing power at the other, a major expansion of the shopping center is expected to be toward the southwest, between Market and Geary Streets. It should be noted, however, that all large cities are experiencing decentralization of certain types of business and service establishments and San Francisco is no exception. The transportation improvements recommended herein may be expected to play an important part in stabilizing the downtown district.

One major development that is under serious consideration and has been given due recognition is the proposed World Trade Center. It has been assumed that such a development will probably take place either n the area now occupied by the wholesale produce district, north of he financial district, or around the foot of Market Street.

The composite transportation plan for the Downtown District may e summarized as follows:

This district has been treated as a terminal district for both public transit and private vehicular traffic. On the rapid transit system, for example, provision has been made for stations at numerous well-distributed points throughout the area, affording a wide selection to suit the convenience of all riders.

With no possibility of augmenting the street space now available in this district because of high property values, it has

been deemed advisable to use the downtown streets largely for transit service. Transit vehicles serve far more people per unit of street space than private vehicles, and do not require parking space. Accordingly, the transit lines have been arranged to penetrate every part of the business district, delivering riders as close as possible to their destinations, while parking terminals for private vehicles are recommended in the outer sections of this district.

Much of the transit service will be taken completely off the streets and placed underground, thus helping materially to free downtown streets. Many passengers will arrive in subway stations and proceed through underground concourses to sidewalk exits near their destinations. Many stores, hotels and office buildings will undoubtedly provide direct entrances from the subway platforms and stations. This will tend to reduce sidewalk congestion and add to the comfort and convenience of patrons.

Downtown streets will be freed further by elimination of all remaining street cars and conversion of these lines to curb loading gas or trolley buses.

Certain streets will be cleared entirely of transit operations. Among these are Bush, Post, Ellis, Golden Gate, 5th, 6th, 11th and Harrison. On several others, transit operations will be substantially reduced. It is also possible that cable cars may ultimately be eliminated from Pine and O'Farrell Streets to permit their full use as important one-way traffic feeders.

Surrounding the downtown district will be the traffic distributor loop consisting of the Central Freeway, Broadway Tunnel and Expressway, and Embarcadero improvements. This loop will collect traffic from all the incoming freeways and bay crossings and feed it into the central district from its periphery. On-and-off ramps are coordinated with one-way feeder streets such as Pine and Bush, Post and O'Farrell, Turk and Golden Gate, 7th and 8th, 9th and 10th Streets.

Incoming traffic from surface thoroughfares such as Geary, Market, South Van Ness, Potrero and 3rd Streets, will be intercepted at the periphery by a distributor street system composed of Van Ness, 13th, Bryant and Harrison, and The Embarcadero. Traffic will be fed into the central district from these thoroughfares on all available local streets.

Before reaching the congested central core, motorists will find a belt of off-street parking structures located at the fringe of high property values. These structures might be arranged to be entered from the next street back of the main business frontage, with pedestrian exits through the building. Such arrangement will bring parking spaces within 800 feet walking distance of the principal destinations without pre-empting centrally located property. It will also preserve the continuity of bus-

iness frontage on important shopping streets, avoid vehicular conflict with pedestrian traffic and help to keep the principal business streets free for buses and other pick-up and delivery vehicles. Site acquisition costs are reasonable and costs can be further reduced by reserving the ground floors of parking structures for business uses.

The augmented system of one-way streets in the downtown district will improve traffic circulation by eliminating many conflicting left turns, reducing interference between turning vehicles and pedestrians, increasing usable street capacity, and permitting faster signal timing.

Most of the through traffic now using the downtown streets will be by-passed by the proposed freeways and expressways. This will provide measurable traffic relief in the central area.

Airport and suburban buses will be kept out of the congested business center by routing them from the freeways directly to existing and proposed off-street terminals. Valuable street space should not be utilized for free terminals as is now done around Union Square and at the Key Terminal. Terminal facilities for the airline buses are proposed at the 2nd Street bus terminal. Key System bus passengers should be delivered to the proposed East Bay Transfer Station and thence to the San Francisco terminal by train.

The combined effect of this program of transportation improvements in the downtown district will be to make it easier for more people to reach this center for business, shopping and pleasure. Necessary traffic will be kept flowing, while much unnecessary traffic will be drained away. The number of pedestrians - who are the potential customers and the life blood of the district - can be increased and it will be easier and safer for them to get around. Business will be aided by the relief from traffic strangulation. Unwarranted decentralization will be combatted and natural growth encouraged. The ensuing benefits will be shared by the entire city.

# CHAPTER I

## SAN FRANCISCO AND THE BAY AREA

### Location and Extent

This transportation planning project encompasses the City and County of San Francisco and - to the extent that it is reflected in San Francisco's terminal problems - the entire San Francisco Bay Area-one of the great metropolitan areas of the United States. It contains approximately 3000 square miles with a population of about 2.5 millions. It has been growing rapidly and at a spectacular rate in recent years.

The Bay Area extends roughly 60 miles north and south and 50 miles east and west. It includes all or parts of the nine counties bordering San Francisco Bay - Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano and Sonoma - and contains 50 incorporated municipalities. The population of the nine counties in 1947 has been estimated by the Office of the Director of Planning and Research as follows:

| | |
|---|---|
| Alameda | 735,000 |
| Contra Costa | 280,000 |
| Marin | 80,000 |
| Napa | 44,700 |
| San Francisco | 785,000 |
| San Mateo | 190,000 |
| Santa Clara | 255,000 |
| Solano | 114,500 |
| Sonoma | 90,000 |

The Bay Area may be further defined as all the territory around San Francisco Bay that is tied together by common economic or social interest, including industries, business activities, transportation facilities, educational, recreational and cultural institutions.

It is the western terminus of three transcontinental rail lines, two transcontinental highways, and three transcontinental airlines, and at the gateway to most trans-Pacific sea and air routes. It is also a mid-point on the coastal trade routes and the principal outlet and distribution point for the fertile Central Valley of California.

The heart of the Bay Area's economic and social activity is San Francisco, located on the west side of the bay at about its mid-point. The City and County of San Francisco are identical, politically and territorially. They occupy 44 square miles at the northern tip of the San Mateo peninsula, separating San Francisco Bay from the Pacific Ocean. The city is about seven miles across, each way.

### Physiographic Characteristics

The location, character and extent of development in various parts of the Bay Area have been influenced in a more than usual degree by physiographic conditions. This is particularly true of transportation facilities. Any proposals for transportation improvements in the area must be based on an understanding of and take fully into account the special topographical conditions.

Dominating features of the San Francisco area are the San Francisco Bay extending 45 miles from north to south and averaging about six miles in width, and the hilly and mountainous land areas. At the San Francisco-Oakland Bay Bridge it is four miles from shore to shore, while the Golden Gate strait is one mile across at the Golden Gate Bridge. The bay and its several arms and connecting waters separate the area into three major districts - the San Mateo Peninsula, East Bay Shores and Marin Peninsula. Surrounding the bay are steep hills and mountains which further subdivide the territory. Passageways through and across these barriers are limited to a few main travel routes.

Within San Francisco proper, the topographical problems are intensified by dense urban development. The city is surrounded on three sides by water and much of the fourth side is blocked off by mountains. The only portals are the Golden Gate Bridge, the Bay Bridge, the Bayshore Highway, and one natural land gateway on the county line at Daly City. Within the city are several steep hills ranging up to more than 900 feet in elevation. Between and around these hills lie connected valleys which form the natural travel routes, such as followed by the early El Camino Real or Mission Road.

Street grades of up to 10 or 15 per cent are common on main thoroughfares. Trolley buses and gas buses regularly climb 19 per cent grades. Streets with grades up to 33 per cent are paved and in daily use; others still steeper are blocked off to traffic or given special treatment.

Other major barriers to transportation are the larger open land reservations, particularly the Presidio, Golden Gate Park, and Lake Merced with its surrounding lands. The Presidio is two miles long and one mile wide; Golden Gate Park is three miles long and one-half mile wide, and the Lake Merced area one mile by one and one-half miles.

Railroad lines and other railroad facilities fortunately do not offer as much obstruction as in most large cities. Topography has limited both their number and location. The one main line that enters the city (the Southern Pacific from the south) does so by means of a series of tunnels and trestles, thereby minimizing the grade crossing problem.

The shortage of low, level land suitable for industries and railroads led to the filling in of shallow tidelands and marshes along the bay. Two short navigation channels were left indenting the bay front. These will have to be detoured by new thoroughfares, or bridgedat heavy cost.

The climate of the San Francisco Bay Area is highly conducive to year-round use of private and public transportation facilities. Due to the ocean currents and peculiar land forms, summers are cool and winters mild. Rainfall averages 22 inches per year. From June to October there is no rain generally but ocean fogs provide refreshing relief from the heat and drouth of more inland areas. San Francisco is generally considered a delightful place in which to live. Visitors and travelers make up a significant part of its day-to-day population and have to be reckoned with in planning transportation facilities.

Interesting features of this new Promenade were the flag-
stations for embarking or debarking from motor boats and
and as exits to Kirk, and the Utility and Conveniences
the far Promenade-Pavilion are perhaps to be more
above. Until the Outlook Site should be used
Site. The Pier was originally over one hundred
Square the Bowling Green - the New Outlook
at the Shelter and Bath Pavilion. Commencing
and Recreation Ground Pavilion and the Upper
improved and access thereto further limited
ture.

Within the Recreation Ground, the Championship
limited to seven courts, but this is supplemented
the Bowling and Croquet Lawns. The Putting
only section of the Golden Mile. The Boating
Marine Gardens, and the Children's Paddling
Pier. Within the site, the Central Hall
Pier is situated. Between the Central
Bridge which from the Central Parade,
Bay to Queens Road as Marine Drive.

Direct access to or to be in the near
Pavilion. Further down the Front
Gardens. Opposite the Pier Head
Gardens, which provide an
and children's sports
Pavilion.

Other major features in Conservation are the Lower
Promenade, particularly the Shelters, Shops and
Road with its Promenade Trees. The Pavilion
Main Drive, and the Trees in Queens Road
Bay, and the Trees, Lawns and Flower Beds

Natural Cliff and other natural features of
are also characteristics of the Outer Zone.
Cliff Top Marine Parade from the Central
Cliff Lift, Marine Parade from the Central
Pavilion, Queens Road, Queens Parade
Pavilion.

The objective of the Outer Zone is to
the Pier as the visible and
the Outer Zone is to
Zone will also be to
Pier.

The objective of the Outer Zone is to
Conservation Area and to provide
the Outer Zone will be to
Pier Head and Pavilion
Pier Head and Pavilion
Pier Head and Pavilion

The topography of the San Francisco Bay Area has affected its development in several ways. While affording one of the world's finest harbors, splendid port facilities, and a fascinating and unique city, it also gave rise to many problems. The numerous land and water barriers have caused people to settle in highly concentrated fashion in a few favorable locations, with resulting extreme population densities and high land values.

On the other hand, the rugged topography of the city which contributed to many of its present problems was not without advantages. It prevented or mitigated the indiscriminate intermingling of industrial and residential areas, so common in other large cities, by confining major industrial developments and railroad facilities to low-lying, level sections. Topography also furthered the development of residential parts of the city in the form of well defined communities and neighborhoods, self contained in respect to most local service facilities and separated from one another by natural barriers or open spaces - a type of urban pattern now generally regarded as most desirable. Routes for freeways and rapid transit lines can still be found in undeveloped canyons and along hillsides where a natural separator already exists. The compact development of the city makes possible efficient and economical public transit. The natural concentration of railroads and industries in well defined areas simplifies the provision of trucking routes and freight terminals. Full advantage has been taken of these favorable factors in preparing the plans recommended herein.

DE LEUW CATHER & CO. CONSULTING ENGINEERS • LADISLAS SEGOE CONSULTING CITY PLANNER

OCTOBER 1948

INTRODUCTION

1

# TOPOGRAPHY AND PHYSICAL BARRIERS

WATER

RAILROADS

PARKS & OTHER RESERVATIONS

MOUNTAINS & ESCARPMENTS

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Land Use Characteristics

The same factors which have caused rapid development of outlying suburban residential, commercial and industrial areas in all American metropolitan centers are present in San Francisco. Consequently, there has been considerable decentralization of both, particularly since the two great bridges were built - the San Francisco-Oakland Bay Bridge and the Golden Gate Bridge.

Most of the industrial growth outside San Francisco has been along the west side of the bay south of San Francisco, on the east side of the San Francisco and San Pablo Bays in the area from Hayward to Crockett, and along the south side of Suisun Bay and the Sacramento River in the vicinity of Martinez, Pittsburg and Antioch. The Bay Area also contains several large and important military supply depots and other military establishments. Camp Stoneman at Pittsburg, Mare Island Navy Yard at Vallejo, Hamilton Field north of San Rafael, the big Army and Naval supply depots in Oakland, the Naval Air Station in Alameda, the Naval Base on Treasure Island, Hunters Point Naval Shipyard in San Francisco, the Presidio in San Francisco, and Sunnyvale Air Training Station near San Jose, are of major importance.

The principal transcontinental rail terminals are located on the east shore of San Francisco Bay in Oakland and Richmond. These include extensive yards, wharves, warehouses and shops. Major airline facilities are at San Francisco Municipal Airport, five miles south of the city on the bay shore, and at Oakland Municipal Airport on the east bayfront near San Leandro.

The general pattern of urban development in the Bay Area, other than San Francisco itself, is characterized by:

A continuous belt of cities and towns 25 miles long and 3 miles wide, lying between the east bay shore and the first range of hills and extending from Hayward to San Pablo, with the large city of Oakland in the center;

Residential suburban settlements lying in the hills and valleys east of Berkeley, to and including Walnut Creek;

Several detached industrial and residential cities and towns along both side of Carquinez Strait and Suisun Bay, including Vallejo, Benicia, Crockett, Martinez, Pittsburg, Antioch and Concord;

A group of small residential suburbs along the bay shore of Marin County, such as Sausalito, Mill Valley, San Rafael, and San Anselmo;

A narrow band of larger residential communities extending 35 miles down the bay shore of the San Mateo Peninsula, from San Francisco to Sunnyvale; and

The residential and industrial city of San Jose and environs, 45 miles south of San Francisco, at the lower end of the bay.

All of these urban and urbanizing areas are closely interrelated with San Francisco, the central city of the Bay Area. Adequate highway connections and frequent transit facilities to and from San Francisco are essential.

A large amount of land in the Bay Area is unsuited for intensive use because of its topography. Much of this land is devoted to recreational use and the rest to stock farming, watershed protection and specialty crops. There are several large national, state and regional parks, and smaller public beaches, that make it possible for the people to enjoy the unusual scenic assets of the area.

For San Francisco proper, a detailed map of existing land uses has just been prepared by the City Planning Commission. The effect of topography on the land use pattern is clearly evident. The industrial districts are concentrated mainly along the bay shore between Fort Mason and Hunters Point, convenient to rail and water terminal facilities. General cargo wharves, which are owned by the State Board of Harbor Commissioners, are located between Fisherman's Wharf, at the foot of Taylor Street, and China Basin. On the lowlands back of these wharves, mainly south of Market Street, are the warehousing, light manufacturing and distributing districts, including most of the rail and motor freight terminals. Some heavy industries are located between China Basin and Hunters Point, but most of the larger ones are outside the city.

The metropolitan business district along and north of Market Street extends about two miles west from the Ferry Building. The shopping district is concentrated about Stockton Street and Grant Avenue from Market to Sutter. The office building and financial district lies east of this, centering along Montgomery Street. These are the two principal concentration areas for traffic and transit riders. Secondary shopping centers are located at natural focal points throughout the city.

The remainder of San Francisco is devoted almost entirely to residential areas and public uses. Immediately west and northwest of the central business district are the principal hotel and apartment house sections, where the population averages 210 persons per net acre. Farther east is Chinatown, with even higher population densities. Elsewhere the residential development consists largely of a mixture of three and four story apartment buildings, flats and row houses. Single-family areas are mostly in the western and southern sections. Areas of detached houses are relatively few and limited in extent.

Most of the residential districts are divided by topographic barriers into natural communities and neighborhoods. Many of these have their own major shopping centers. Here and there are important public and semi-public establishments such as hospitals, colleges, high schools and sports arenas, which must be served by main thoroughfares and transit lines. The few large vacant areas occupy the more rugged hill tops and the farthest reaches of sand dunes near the ocean. The latter, however, are rapidly filling up with new housing.

Insofar as its land resources are concerned, San Francisco is rapidly nearing full development. The only direction in which it can expand is southward into San Mateo County. There has been repeated

consideration of a possible merger with San Mateo County or of annexing some part of it - but with no tangible results to date. In any case, it is most important that San Francisco's limited supply of land be devoted to the highest and best uses from economic and social standpoints.

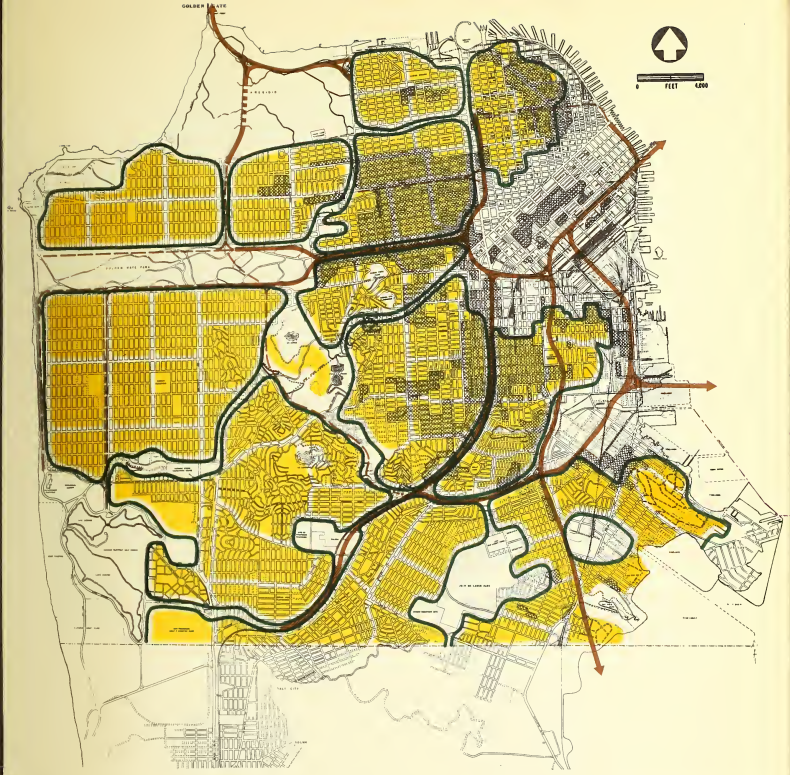
Immediately beyond the 1906 fire area, in the Western Addition and south through the Mission District, are the oldest and most obsolete residential sections. Their decline has been due, in part at least, to the numerous through streets which now traverse them. Their rehabilitation will depend on a reorganization of the street system into a new pattern consisting of a few well-spaced, high capacity thoroughfares including freeways, and with the remaining streets redesigned to serve only the local residential needs. A preliminary plan for the redevelopment of the Western Addition has been prepared by the City Planning Commission along these lines, and the proposed Transportation Plan has been made to conform to this plan.

The Land Use Plan

The Transportation Plan presented herein is intended to serve as a basis for the Transportation Section of the Master City Plan of San Francisco. Another basic part of the Master Plan is the Land Use Section, the revision and extension of which the Department of City Planning is currently preparing. Fortunately, both of these were in preparation at the same time and hence every effort was made to coordinate one with the other as the work progressed.

In developing the Transportation Plan, the aim has been not only to solve the transportation problems but to do this in such a way as to utilize to best advantage the community-shaping potentialities of transportation facilities. Every effort was made not to impair but to strengthen instead the existing and desirable future pattern of land uses, neighborhoods and communities. Transportation facilities have been planned to conserve existing sound developments and to further desirable future community development, especially in the areas that are as yet undeveloped and those requiring redevelopment. A brief discussion of fundamental land use planning principals may be helpful to an understanding of the considerations and methods employed in the effort of attaining the foregoing objectives.

The Land Use Plan is based on the concept that the city has two basic functions - it is a machine for production, distribution and services; and it is a place for living. To perform both functions effectively, the city must be functionally designed. The urban production and distributing machine, that is, the major industrial areas together with the principal transportation facilities should be brought together in well defined industrial belts or districts; and the residential or living areas should be organized into reasonably self-contained communities and neighborhoods. Land should be allocated adequately for each of these two major functional types of areas and each area should be made desirable for the purposes it is to serve - one for efficient industrial production and distribution, and the other for satisfactory and satisfying living. Because of the conflict between the activities and requirements in areas of these two basic categories, they have to be carefully separated one from the other and buffered wherever possible by transitional or neutral uses or other methods.

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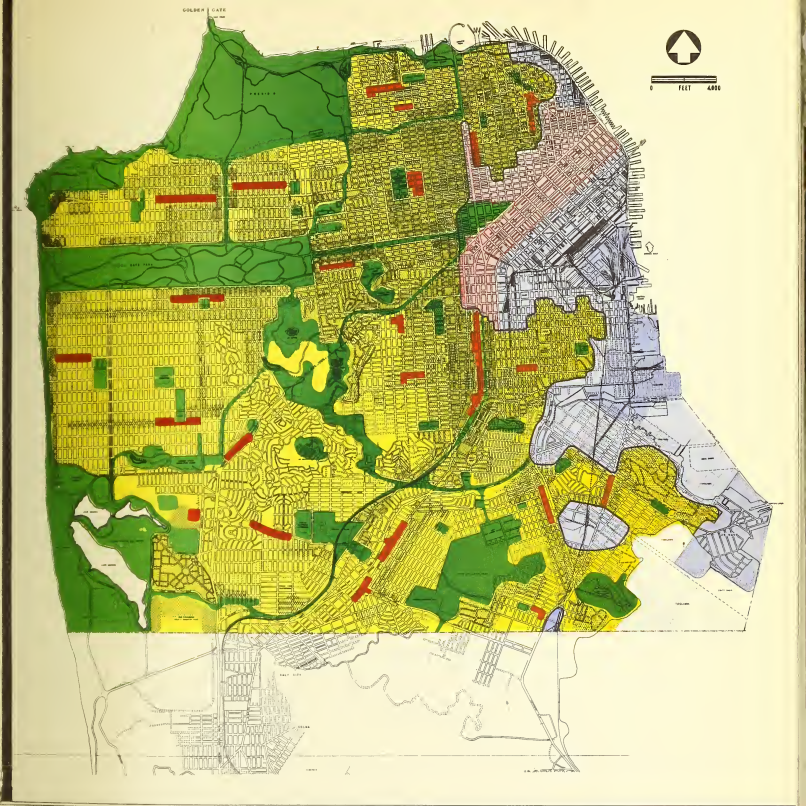
# COMMUNITIES, NEIGHBORHOODS AND BLIGHT

COMMUNITY BOUNDARIES
NEIGHBORHOODS
BLIGHTED AREAS
FREEWAYS
EXPRESSWAYS

2

PLATE

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INTRODUCTION

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# GENERALIZED PRELIMINARY PLAN OF LAND USES

## REVISION OF THE LAND USE SECTION OF THE MASTER PLAN

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- COMMUNITY CENTER AREAS
- MAJOR PUBLIC & SEMI-PUBLIC AREAS
- COMMUNITY SHOPPING
- CENTRAL SHOPPING
- LIGHT INDUSTRY
- HEAVY INDUSTRY
- LIVING, NON-LIVING BOUNDARY

3

PLATE

Fortunately the concentration in San Francisco of most industries and major transport facilities in rather well defined areas and the likewise well defined pattern of natural communities afford an excellent basic for this kind of organization of the land use plan of the city - more so than in most other cities. The job consists, in the main, of building upon an indigenous structural form and land use pattern by strengthening and extending the same.

The living areas must be separate from the working and service areas, as has been mentioned, but there must be ways of moving quickly and conveniently from one to the other. People going to the shopping and business centers should not have to pass through heavy industrial districts, and industrial traffic should be kept out of the residential areas. Where industrial areas must adjoin the residential areas, a cushion or separator should be provided wherever possible to insulate the residential areas from the traffic, noises, and odors of the industrial areas. Wide freeways and expressways can sometimes be used for this purpose.

The Land Use Plan provides for organizing the residential areas of the city into Neighborhoods and Communities. The Neighborhood is defined as the primary unit of residential area, containing an elementary school, one or more neighborhood playgrounds, and at least one local shopping center. In order that children will not have to cross heavy traffic to reach the school or playground, it is very important that major streets carrying through traffic shall not pass through the neighborhoods but between and around them. The neighborhood boundaries, therefore, will be largely determined by the Trafficways Plan, and vice versa.

A Community is a group of neighborhoods having common major service facilities such as a high school, playfield and large park, and a major shopping center. While communities require internal thoroughfares and transit lines to serve the neighborhoods and focal points within them, the long distance trunk line transportation routes - rail or highway - should pass between the communities or should be well insulated by wide right-of-ways and planting to avoid a blighting effect. Community boundaries are determined by natural or man-made barriers, including trunk line trafficways.

A preliminary Community and Neighborhood Units Plan, and a generalized Land Use Plan, have been prepared by the City Planning Commission and were made available to the consultants for their guidance in their work on the Transportation Plan. Every effort has been made to give practical recognition to these plans. They call for the establishment of 11 residential communities and 98 neighborhood units. The areas for general business, service and industries are designated in the Land Use Plan along the bayfront lowlands, where they are at present, with allowance for growth in the Islais Creek, Hunters Point and Bayshore sections. Some further development of major outlying business centers is indicated. High density apartment sections are also indicated, as well as the proposed locations of major service institutions. Some additional recreational areas are proposed. The trafficways and transit facilities have been laid out with these developments in mind, as portrayed on the accompanying plates.

## Economic Characteristics

The San Francisco Bay Area owes much of its economic growth to its natural transportation advantages. Because of its superior harbor and strategic location it has become one of the world's great metropolitan areas. Service, trade, manufacturing, and transportation industries constitute its principal sources of livelihood. As the state's second largest manufacturing center, it employs one-third of the wage earners in manufacturing in the state and produces one-third of the value added by manufacture. It accounts for 43 per cent of the state's wholesale trade. In shipping, it is second only to New York in value of goods handled and fifth in tonnage. It has a widely diversified economic structure conducive to economic stability. Family incomes are consistently among the highest in the United States, affording a high standard of living.

More specifically, the major activities in the Bay Area are:

Distributing supplies and services to most of California and the eleven western states,

Affording central administrative, financial, professional and shopping services for much of the West,

Importing and exporting raw and finished products,

Processing local and imported raw materials for shipment east and west,

Supplying major facilities for higher education, the arts, sciences and entertainment, and

Serving large numbers of travelers and tourists.

San Francisco's port facilities are among the best in the world. Virtually all the general cargo wharves and some special facilities for grains and cold storage are under the State Board of Harbor Commissioners, served by a broad industrial thoroughfare and a state-owned Belt Railroad which connects with all rail lines. In recent years, considerable growth has taken place in some of the East Bay ports, notably Oakland and Richmond.

## Population Characteristics

The San Francisco Bay Area constitutes one of the great population centers of the United States. It is estimated that in 1947 the nine Bay Counties had a total population of 2,574,000, making it comparable, for example, to the Detroit Metropolitan Area. This is one-fourth of the total population in California.

For a hundred years since the discovery of gold in 1848, California has been conspicuous among the states for its rapid growth in population. The Bay Area shared in this growth, ranging between 15 per cent and 28 per cent per decade since 1880. There was a temporary levelling off in the 1930's but this has been more than made up by the spectacular growth during the war years. There is every reason to believe that the Area will continue to experience a substantial growth.

Population forecasts, supplied by the Department of City Planning based on studies by the State Office of the Director of Planning and Research, indicate that any plan of transportation facilities to meet the requirements of San Francisco in the next 20 years should anticipate a population of about 3,600,000 in the Bay Area by 1970.

Thirty per cent of the Bay Area population is now located in San Francisco proper, and almost an equal proportion in Alameda County. The following table shows the percentage distribution of the Bay Area population among the nine counties from 1890 to 1947:

PERCENTAGE DISTRIBUTION OF POPULATION AMONG THE BAY COUNTIES - 1890 TO 1947

| Nine Counties | 1890 | 1900 | 1910 | 1920 | 1930 | 1940 | 1947 |
|---|---|---|---|---|---|---|---|
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Alameda | 17.14 | 19.78 | 26.59 | 29.10 | 30.09 | 29.58 | 28.55 |
| Contra Costa | 2.47 | 2.74 | 3.42 | 4.56 | 4.98 | 5.79 | 10.88 |
| Marin | 2.39 | 2.39 | 2.71 | 2.31 | 2.64 | 3.05 | 3.11 |
| Napa | 3.00 | 2.50 | 2.14 | 1.75 | 1.45 | 1.64 | 1.74 |
| San Francisco | 54.59 | 52.08 | 45.04 | 42.83 | 40.20 | 36.59 | 30.48 |
| San Mateo | 1.84 | 1.84 | 2.87 | 3.11 | 4.91 | 6.45 | 7.38 |
| Santa Clara | 8.77 | 9.15 | 9.02 | 8.51 | 9.20 | 10.09 | 9.91 |
| Solano | 3.82 | 3.67 | 2.98 | 3.43 | 2.59 | 2.83 | 4.45 |
| Sonoma | 5.98 | 5.85 | 5.23 | 4.40 | 3.94 | 3.98 | 3.50 |

From this table it will be noted that an increasing percentage of the people have settled outside San Francisco proper. The early rapid development of the central parts of the Bay Area has left relatively little vacant desirable land. The suburban areas have attracted most of the additional residential development and many new industrial and trade establishments. Thus, while San Francisco and Oakland have continued to grow, the Bay Area reflects the trend characteristics of most metropolitan areas toward greater growth on the periphery. The trend is especially marked in San Francisco where since 1856 city boundaries have not been expanded to encompass outlying areas.

An indication of where the trend will probably lead is shown on Plate I-4. The districts shown have been set up in relation to the primary gateways to the Bay Area Metropolitan Traffic Survey Area, which includes both San Francisco and the East Bay cities, and to the commuting territory. The projected increases in population were estimated by local planning authorities, based on past trends, recent developments, and basic land use potentialities, and were correlated with county estimates made by the Office of Planning and Research.

Important increases are expected by 1970 in Marin County, central Contra Costa County, northern Alameda County, the San Mateo County bay shores, and northwestern Santa Clara County. As a result, probably more than 75 per cent of the Bay Area's population in 1970 will be living outside of San Francisco. Consequently, it is going to be increasingly important to San Francisco to provide attractive

commuter services and radial highways into the surrounding territory if it is to retain its relative importance.

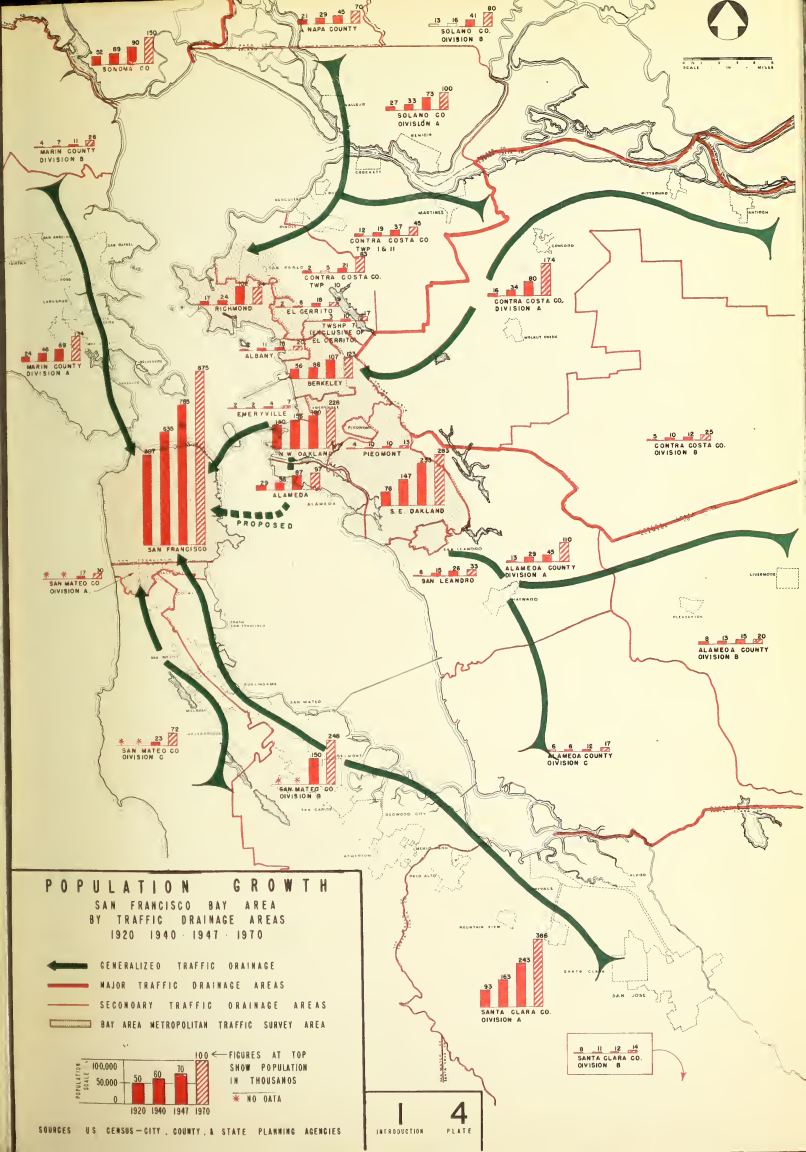
Within San Francisco, the population will undoubtedly continue to increase but at a declining rate. By 1970 resident civilian population is expected to reach approximately 875,000 - an increase of nearly 100,000 over 1947.

The present distribution of population within San Francisco is shown on Plate I-5. The sections north and west of the business district are most heavily populated, with other highly developed sections farther west in the Richmond District and south in the Mission District. Some areas are almost devoid of people. These are mostly the higher, more inaccessible hill-tops or the areas used for industrial, transportation and utility purposes. Despite these vacant or non-residential areas, the density of population in San Francisco as a whole averages 17,720 persons per square mile, as compared with an average of only 6,846 in Oakland, the second largest city in the Bay Area. High population densities generate large volumes of traffic within limited areas and aggravate the parking problem. They also make necessary high-capacity types of transit facilities such as subways, and a rather close spacing of local transit lines.

Some of the remaining undeveloped sections of San Francisco are expected to build up in the next few years to the point where they, too, will require modern trafficways and transit services. The transportation plans have taken this into account. Other sections are likely to lose population through redevelopment for industrial and commercial purposes, and the character of their transportation requirements will change. Past and anticipated population changes in various parts of San Francisco from 1920 to 1970 are shown on Plate I-8. Nearly all parts of the city will experience some population growth, but the outlying sections obviously will increase the most.

Studies to determine where people work have also been prepared by the Department of City Planning. Within the Bay Area there is considerable commuting, not only to and from San Francisco as an employment center, but also to Oakland and other concentrations of employment. About 110,000 persons come to San Francisco daily to work; at the same time some 30,000 San Franciscans go to other work-centers around the Bay.

Two-thirds of the 470,000 workers in San Francisco go to work daily in the non-living areas of the city, which are mostly in the eastern and northeastern parts of the city. The principal centers of employment are shown on Plate I-9. Outside the Metropolitan Traffic District there is no one employment concentration of as many as 10,000 workers. The effect on transportation requirements is obvious.




# POPULATION GROWTH

SAN FRANCISCO BAY AREA
BY TRAFFIC DRAINAGE AREAS
1920 · 1940 · 1947 · 1970

GENERALIZED TRAFFIC DRAINAGE

MAJOR TRAFFIC DRAINAGE AREAS

SECONDARY TRAFFIC DRAINAGE AREAS

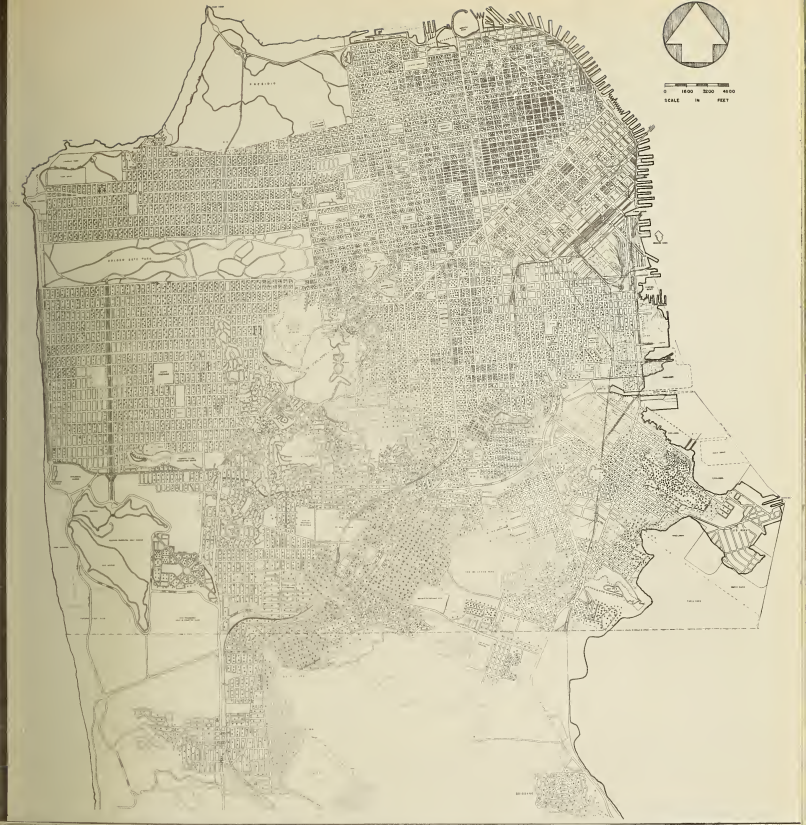
BAY AREA METROPOLITAN TRAFFIC SURVEY AREA




← FIGURES AT TOP SHOW POPULATION IN THOUSANDS

* NO DATA

SOURCES U.S. CENSUS — CITY, COUNTY, & STATE PLANNING AGENCIES

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# 1948 POPULATION DISTRIBUTION SAN FRANCISCO

BASED ON 1940 CENSUS, 1945 SAMPLE CENSUS, AND FIELD CHECKS.

ONE DOT REPRESENTS 50 PERSONS

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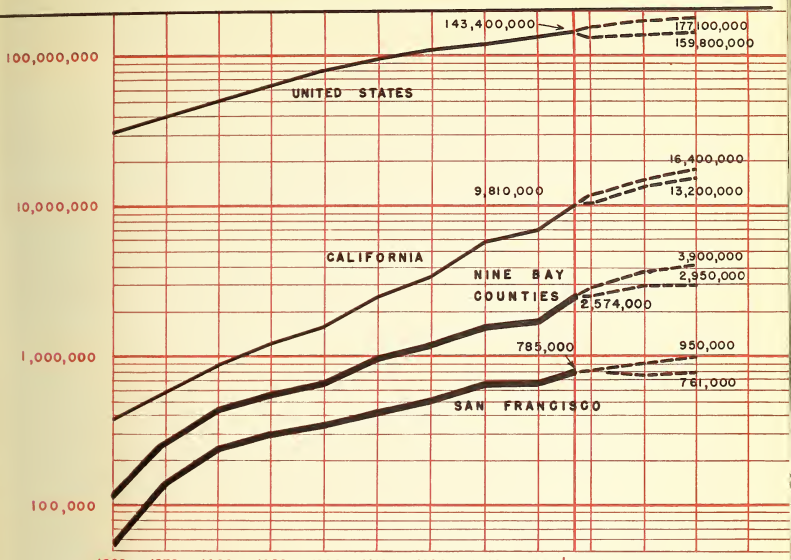
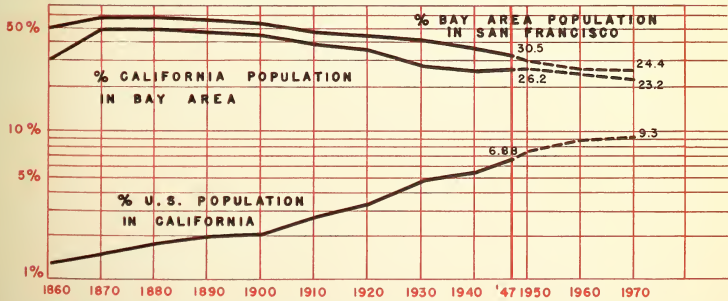
# POPULATION GROWTH & FORECASTS

## SAN FRANCISCO AND THE BAY AREA




Note: High and low figures for 1970 indicate range of probabilities as determined by various authorities.

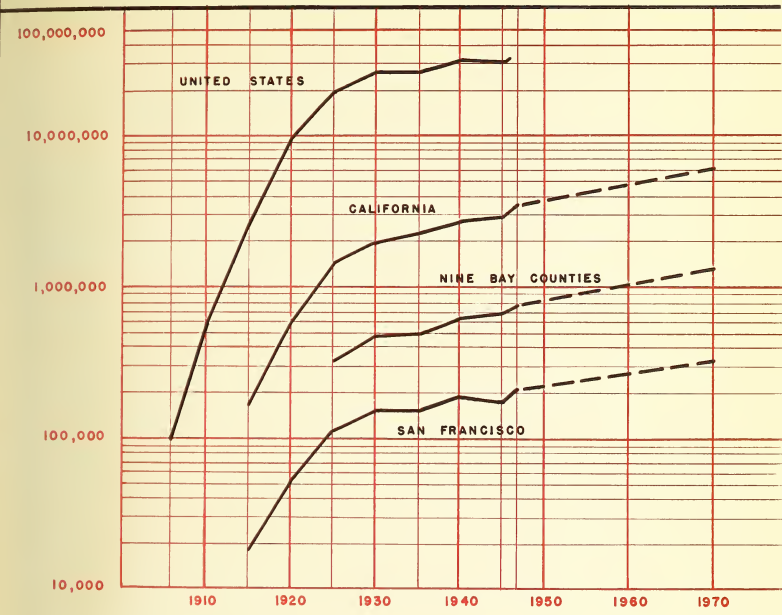
## POPULATION RATIOS

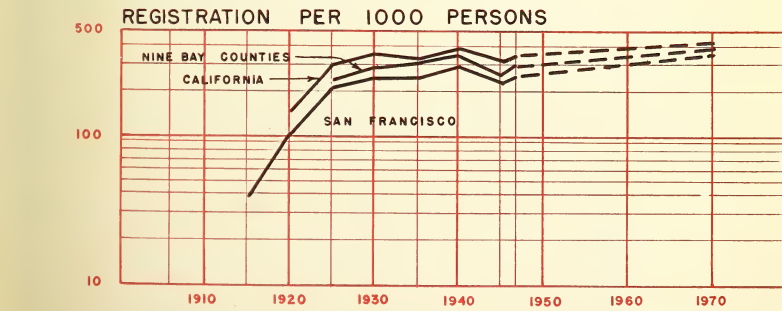



SOURCES: UNITED STATES CENSUS
CALIFORNIA STATE OFFICE OF PLANNING AND RESEARCH
SAN FRANCISCO DEPARTMENT OF CITY PLANNING

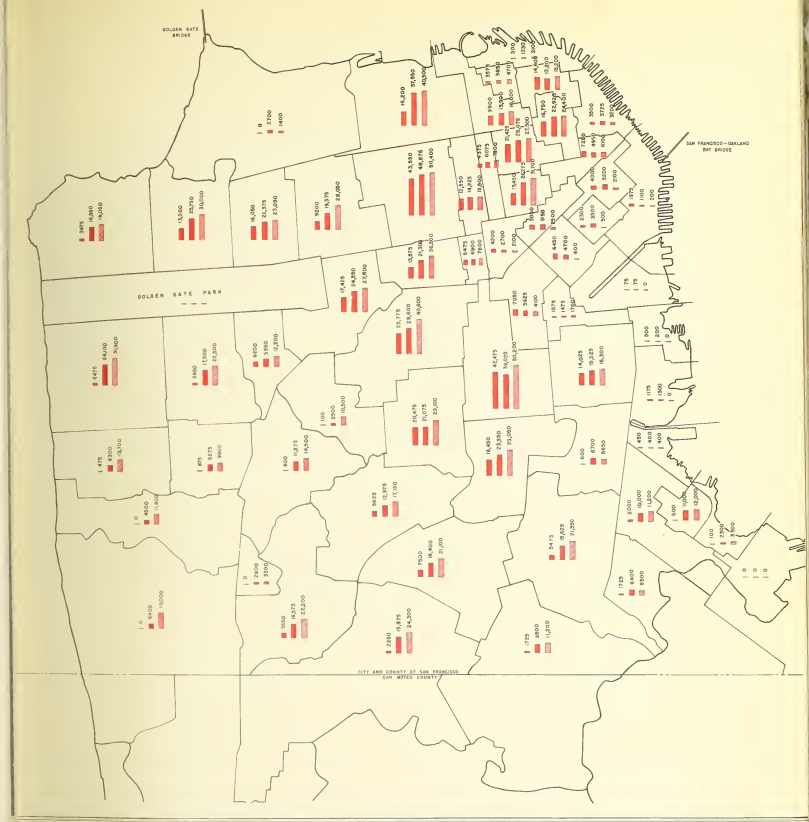
# TRENDS IN AUTO REGISTRATION, 1906 - 1970

UNITED STATES · CALIFORNIA · NINE BAY COUNTIES · SAN FRANCISCO




SOURCES: U.S. PUBLIC ROADS ADMIN., AUTO MANUFACTURERS ASSN., & CALIF. STATE DEPT. OF MOTOR VEHICLES

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# POPULATION GROWTH IN SAN FRANCISCO

## BY SEGMENTS 1920 - 1947 - 1970

1920 1947 1970

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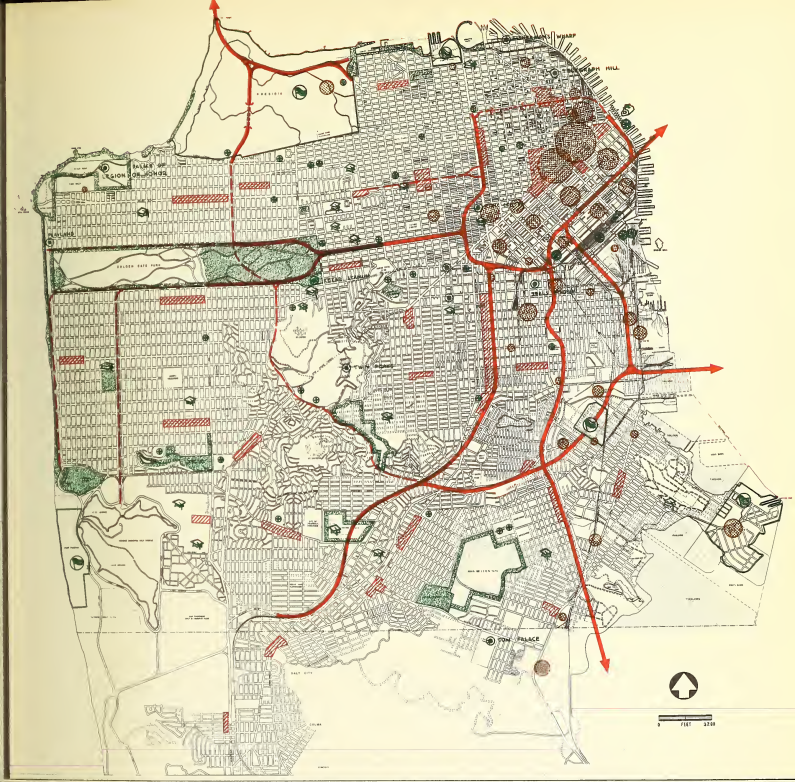


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# MAJOR EMPLOYMENT CENTERS AND OTHER TRAFFIC GENERATORS

## EXISTING AND PROPOSED

EMPLOYMENT CENTERS* — BUSINESS DISTRICTS

HIGH SCHOOLS AND COLLEGES — MILITARY AREAS

HOSPITALS AND INSTITUTIONS — RAILROAD PASSENGER DEPOTS

LARGE PARKS — RAILROAD FREIGHT DEPOTS

INTENSIVE RECREATION AREAS — MISCELLANEOUS CENTERS

*AREA OF CIRCLE IS PROPORTIONAL TO NUMBER OF PERSONS EMPLOYED IN VICINITY

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The tendency of San Francisco's employment is to increase no less rapidly than its resident population. Devotion of an increasing portion of the City's area to business and industrial uses should continue this trend. Commuting can be expected to increase because of greater specialization in San Francisco toward wholesale trade, services, and light industry, and greater specialization in some other parts of the area in heavy industry.

Automobile Registration

Another factor of importance in transportation planning is the present and prospective ownership of motor vehicles. If no major economic changes occur, it may be expected that motor vehicle registration in San Francisco and the Bay Area will continue to increase somewhat faster than the population. The per capita automobile ownership in the Bay Area, and San Francisco in particular, has always been lower than for California as a whole. The tendency will be for it to catch up. This trend, coupled with a general continued increase in automobile ownership, indicates that by 1970 there will probably be a total registration of 1,500,000 vehicles in the nine Bay Counties, with 320,000 of these in San Francisco proper. This would amount to an increase over 1947 registrations of 50 per cent in San Francisco and 90 per cent in the Bay Area as a whole.

Assumption as to Future Growth

Assumptions as to future growth may be summarized as follows:

1. There is every indication that California will continue to increase in population faster than the United States as a whole, and that the Bay Area will keep pace. An increase of about 40 per cent in the Bay Area is estimated.

2. The outer parts of the Bay Area will continue to increase at a faster rate (averaging 74 percent) as compared with an increase of not over 20 percent in the central parts.

3. Direction of growth in the Bay Area commuting districts by 1970 is indicated at the following rates:

   Marin Peninsula .....82%
   East Bay .....41%
   San Mateo Peninsula....68%

4. Employment will continue to increase in all counties. Numerous outlying centers, both in San Francisco and outside, will assume increasing importance; but downtown San Francisco will always remain the primary focal point for daytime traffic in the Bay Area.

5. Heavy industries requiring extensive sites will tend to locate or expand across the bay and south along the San Mateo bayshore.

6. Light industries, wholesale houses, and some types of warehouses which make intensive use of land and require central locations will continue to increase in San Francisco proper, within the designated industrial districts.

7. The few remaining vacant lands in San Francisco suitable for residential use will be developed. The future population in these areas has been estimated for this study.

8. Extensive residential growth will take place in all outlying areas around the bay and beyond the hills in Contra Costa County.

9. San Francisco will find itself increasingly in competition with other Bay Area communities in providing attractive living conditions. Provision of modern transit service, elimination of street congestion, rearrangement of thoroughfares to pave the way for quiet and otherwise desirable neighborhoods, provision of modern schools and more open spaces, especially local playgrounds and parks, are among the improvements needed to make living in the city more attractive.

## TRAFFIC AND TRANSPORTATION SURVEYS

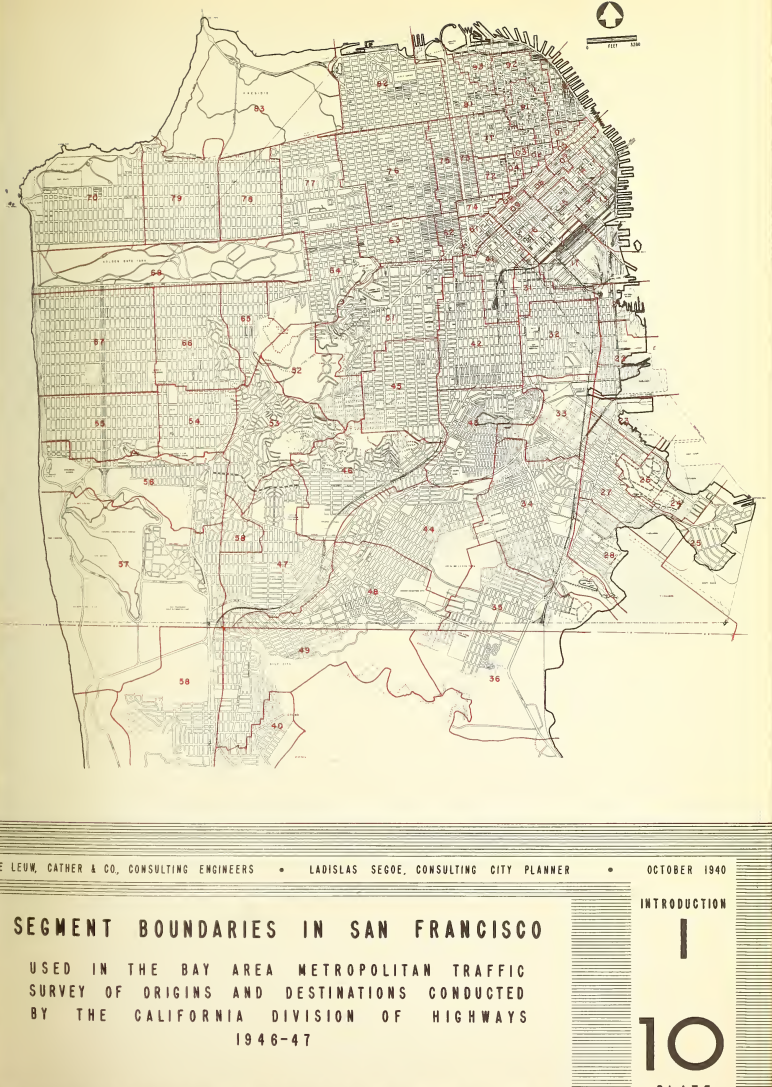
The traffic surveys available for this report are the most comprehensive ever available for the City and County of San Francisco and represent the cooperative activities of federal, state and several city agencies. The most important of all the surveys and the backbone of this report is the origin and destination survey made under the supervision of the California Division of Highways together with the Public Roads Administration, the City of San Francisco and other cities within the Bay Area Metropolitan Traffic Survey Area.

The home interview method through which these data were collected is a relatively new technique but has been well established. It has been successfully used in some 70 American cities. Although costly, this method of collecting data is justified by the need of accurate information to insure the best design and location of very expensive vehicular and public transit facilities required to meet modern complex traffic demands.

### Description of Origin and Destination Survey

The survey area covered both sides of San Francisco Bay - 107 square miles on the East Bay side and 51.1 square miles on the San Francisco side. The San Francisco Area (including Daly City and Colma) was divided into subdivisions for convenience of handling as follows:

10 Sectors,
73 Segments,
338 Zones, and
525 Subzones.



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# SEGMENT BOUNDARIES IN SAN FRANCISCO

USED IN THE BAY AREA METROPOLITAN TRAFFIC SURVEY OF ORIGINS AND DESTINATIONS CONDUCTED BY THE CALIFORNIA DIVISION OF HIGHWAYS 1946-47

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The subdivisions utilized mostly in these studies were zones in the San Francisco Metropolitan Traffic District and segments outside the Metropolitan Traffic District.

The basic data were collected by carefully controlled interviews classified into two broad phases - internal and external.

For the internal survey a study of Sanborn maps was made supplemented by a field survey of new and temporary construction to determine the number of residences in each individual zone. Interviews were then made at 5 per cent or one out of every twenty homes in each zone. This procedure resulted in 27,700 home interviews. Specially trained interviewers questioned occupants concerning the details of all trips made by all members of the sample household for the previous day. The interviews were only conducted on Tuesdays through Saturdays (days following holidays excepted), giving a typical weekday pattern. One out of seven taxi drivers and truck drivers (approximately 15 per cent) were interviewed, resulting in interviews with drivers of 226 taxis and 7,160 trucks.

The external survey of persons living outside of the survey area was conducted by interview at roadside stations on the boundary of the survey area. A total of 15 roadside stations were set up, of which seven were on the San Francisco side of the bay. The San Francisco-Oakland Bay Bridge being within the survey area was not an external station although for the purpose of this report trans-bay traffic is considered as external traffic.

Internal interviews were made between July 12, 1946 to April 30, 1947. External interviews were made within the same period and correlated with the internal information.

Daily traffic counts made at selected control points were compared with trips reported through these points as expanded. Accuracy of the O-D survey is shown by the fact that these was close agreement between these comparisons, with only a 16 per cent difference in the worst case.

The data collected in the field were expanded in such a manner as to develop typical weekday travel between all external stations and the several segments and zones in the survey area as well as between all of these internal areas. These data were recorded on cards and the summaries required for various studies produced by IBM tabulators. We are greatly indebted to the California Division of Highways and the Public Roads Administration for their cooperation in making available those summaries required for the San Francisco studies.

The data collected from the origin and destination surveys make it possible to learn where people go, the time pattern of travel, the trip purposes and modes of transportation. Knowledge of these facts provides the basis for selecting route locations to best serve the traffic needs of the area. Estimates can also be made of the traffic volume which will use the various sections of the proposed routes as well as the use of the proposed access facilities.

The movement of vehicles and passengers was divided into four principal classifications as follows:

1. Station to Station - Those trips which went directly from one external roadside interview station to another station without stopping within the area.
2. Station to Segment - Trips from roadside stations to segments within the area and reverse.
3. Segment to Segment - Trips between segments within the area.
4. All mass (passenger) transportation trips.

A recapitulation of these total two-way trips follows:

| Class of Trip | Station to Station | Station to Segment | Segment to Segment | Total |
|---|---|---|---|---|
| Motor Vehicle Trips | | | | |
| Passenger Cars and Taxis | 6,213 | 110,191 | 586,815 | 703,219 |
| Trucks | 501 | 13,551 | 197,858 | 211,910 |
| Total Vehicle Trips | 6,714 | 123,742 | 784,671 | 915,129 |
| Trips Incomplete | | | | 3,634 |
| Total | | | | 918,763 |
| Passenger Trips*(excluding drivers) | | | | |
| Passengers in Passenger Cars and Taxis | 544 | 83,488 | 573,911 | 657,943 |
| Public Transit Passengers | 3,082 | 68,117 | 242,553 | 313,752 |
| Total Passenger Trips | 3,626 | 151,605 | 816,464 | 971,695 |

*-The above recapitulation was prepared from tabulations prepared by BAMTS. A special survey of Southern Pacific and Greyhound patrons was conducted by the four city departments and the consultants, and it was determined that approximately 30,000 trips from Station to Segment are made on these transit routes.

Since the greatest concentration of traffic movements is to the Metropolitan Traffic District, a group of zones approximating this district were analyzed separately. A recapitulation of trips to and within these zones were as follows:

| | Trips | Per Cent of M.T.D. | Per Cent of Total |
|---|---|---|---|
| Trips Between M.T.D. Zones | | | |
| East Bay (External) | 31,705 | 7.9 | 3.5 |
| Other External Stations | 21,950 | 5.5 | 2.4 |
| San Francisco Segments | 212,229 | 53.1 | 23.0 |
| M.T.D. Zones | 131,934 | 33.1 | 14.4 |
| Incomplete Data | 1,610 | 0.4 | 0.1 |
| Total M.T.D. | 399,428 | 100.0 | 43.4 |
| Other Trips within San Francisco between San Francisco and | | | |
| East Bay (External) | 31,019 | | 3.4 |
| Other External Stations | 44,512 | | 4.9 |
| San Francisco Segments | 440,510 | | 48.0 |
| External to External | 1,270 | | 0.1 |
| Incomplete Data | 2,024 | | 0.2 |
| Total Other Trips | 519,335 | | 56.6 |
| Grand Total All Trips | 918,763 | | 100.0 |

The following tabulation shows the approximate distribution of trans-bay vehicular trips:

| Trans-bay Trips to and from | Trans-bay Trips | Per Cent |
|---|---|---|
| M.T.D. | 35,200 | 50.0 |
| San Francisco Segments | 29,424 | 42.1 |
| San Francisco Externals | 5,576 | 7.9 |
| Total Trans-bay | 70,000 | 100.0 |

## Suburban Passenger Terminal Studies

Because no origin and destination data were collected by the BAMTS survey pertaining to external public transit traffic, a post-card survey of persons entering and leaving the three Greyhound Bus Terminals and the Southern Pacific Railroad Terminal was conducted by the four departments and the consultants.

The survey was made between 7:00 A.M. and 7:00 P.M. on January 20 and 21, 1948. A total of 21,516 cards was distributed, of which 6,374 or 29.6 per cent were returned. These data were expanded to a typical average day and correlated for use with data from the BAMTS survey. This survey was summarized and published in April, 1948.

## Cordon Counts

Two cordon counts of traffic entering and leaving San Francisco's Downtown Area were made. The Central Business District Cordon (Inner Cordon) was conducted by the California Division of Highways on the same limits as the cordon made for the San Francisco City-Wide Traffic Survey in 1937. The data obtained covered vehicles and did not include passengers. Fifty-eight stations at 34 locations were counted by half-hour periods from 7:00 A.M. to 7:00 P.M. in January and February 1948.

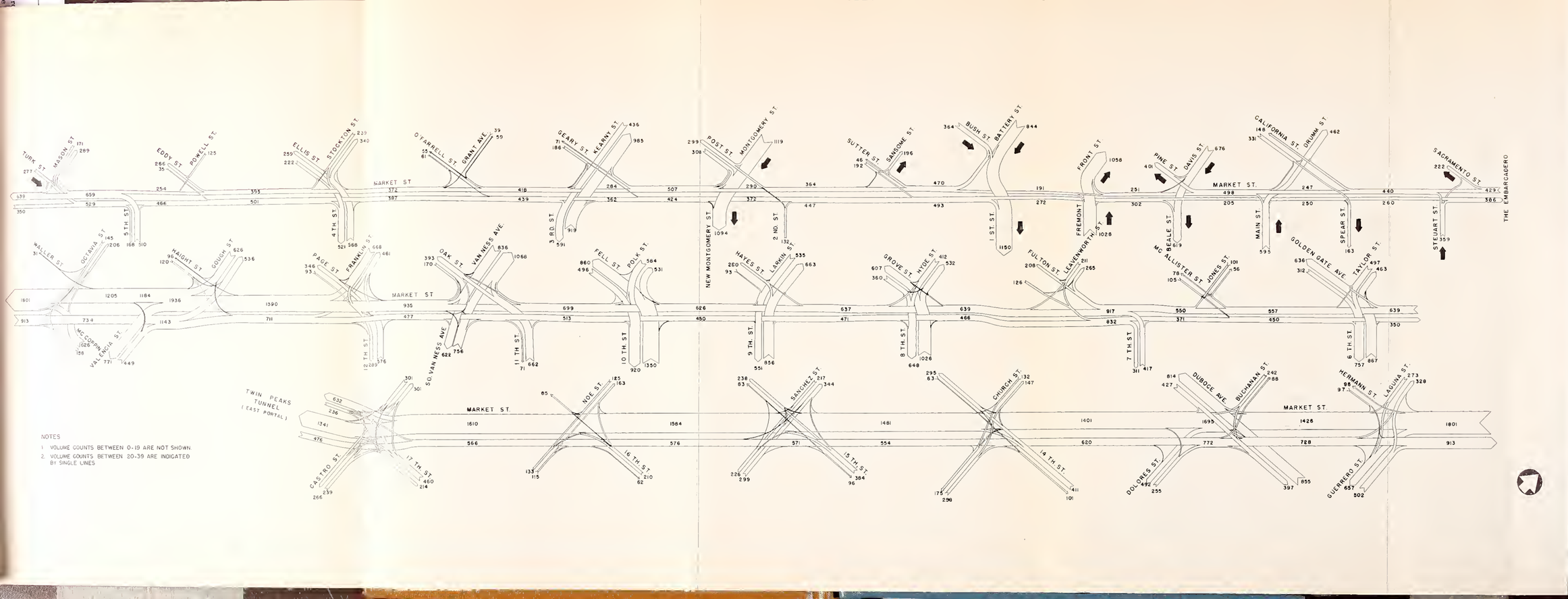
The Metropolitan Traffic District Cordon Count was conducted by the four departments and the consultants over the much larger area included within the Metropolitan Traffic District. The Committee Staff was aided by 70 additional personnel from the Municipal Railway, the Police Department and the Department of Public Works. This count was made the last five days in October, 1947, for 121 stations at 66 locations. Data were recorded by half-hour periods between 7:00 A.M. and 7:00 P.M. An actual count of all vehicles, pedestrians and mass transit passengers was made at all stations. Spot checks of vehicle occupancy were also made at 10 locations to determine the total number of persons entering and leaving the cordon area. These data - of inestimable value in many studies made by the consultants - were published in December 1947.

## Volume Counts

Traffic counts on major traveled streets were made by the California Division of Highways during the year 1947. Where practical, mechanical counters were used to make 24-hour counts. A special crew from the City Engineer's office participated and made half-hour readings during the peak period - 4:00 P.M. to 6:00 P.M.

Detailed manual counts to determine the peak hour flows were made jointly by the special staff and the California Division of Highways within the Metropolitan Traffic District in January and February 1948.

Checks of public transit passengers were made available by the Municipal Railway. These data were supplemented by the four departments and, with the aid of a crew of experienced checkers from the Municipal Railway, provided data on the existing passenger flow pattern of the transit system of a city-wide basis.




NOTES

1. VOLUME COUNTS BETWEEN 0-19 ARE NOT SHOWN.
2. VOLUME COUNTS BETWEEN 20-39 ARE INDICATED BY SINGLE LINES

INTRODUCTION

# PEAK HOUR VEHICULAR TRAFFIC VOLUMES ON MARKET STREET

FROM THE EMBARCADERO TO CASTRO STREET – 4:30 P.M. TO 5:30 P.M. – NORMAL WEEKDAY

BASED ON COUNTS MADE JANUARY TO APRIL 1948

NUMBER OF VEHICLES (INCLUDES ALL STREETCARS & MOTOR VEHICLES)

2000 1500 1000 500 250 100

PLATE 11

DE LEUW, GATHER & CO. CONSULTING ENGINEERS • LADISLAS SEGOE, CONSULTING CITY PLANNER

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

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# PEAK HOUR TRAFFIC FLOW

## IN THE METROPOLITAN TRAFFIC DISTRICT

## 4:30 P.M. TO 5:30 P.M. - NORMAL WEEKDAY - 1948

SCALE OF VEHICLES — INCLUDES AUTOMOBILES, TRUCKS AND TRANSIT VEHICLES

BASED ON TRAFFIC COUNTS MADE BY THE CALIFORNIA DIVISION OF HIGHWAYS AND THE DEPARTMENT OF CITY PLANNING, PUBLIC WORKS AND PUBLIC UTILITIES • JANUARY - FEBRUARY 1948

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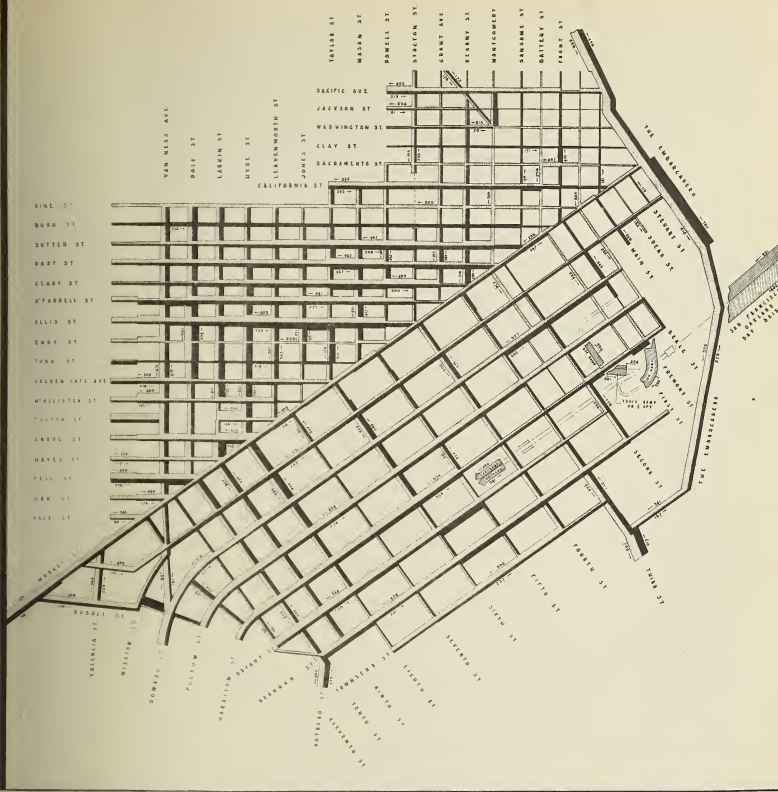


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# PEAK HOUR TRAFFIC FLOW PER LANE

## IN THE METROPOLITAN TRAFFIC DISTRICT

## 4:30 P.M. TO 5:30 P.M. - NORMAL WEEKDAY - 1948

100
200
300
400
500
1000

SCALE OF VEHICLES - INCLUDES AUTOMOBILES, TRUCKS AND TRANSIT VEHICLES

BASED ON TRAFFIC COUNTS MADE BY THE CALIFORNIA DIVISION OF HIGHWAYS AND THE DEPARTMENT OF CITY PLANNING, PUBLIC WORKS AND PUBLIC UTILITIES • JANUARY - FEBRUARY, 1948

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## Parking Surveys

An off-street inventory and turnover survey of all parking facilities within the Metropolitan Traffic District was made by the four departments and the consultants during December, 1947. Operators of approximately 340 facilities were interviewed by members of the Police Department staff as to rates, capacity, peak loads, overnight parking and total use.

Curb inventory of available parking spaces was made by the City Engineer's staff assisted by members of the staff of the Technical Committee. All streets and alleys in the Metropolitan Traffic District were surveyed during the period November and December 1947.

Special curb parking turnover studies on a sample basis were made within the Metropolitan Traffic District by staff engineers loaned by the City Engineer. The recording of license plates at 20-minute intervals between the hours of 9:00 A.M. to 5:00 P.M. were made along 91 lineal blocks in the Metropolitan Traffic District. This study was made on normal weekdays during the first three weeks of September 1948. The data were classified by existing regulations in each section.

Morning curb accumulation studies were made by counting all vehicles within the Metropolitan Traffic District parked at 7:00 A.M. which, together with vehicles parked overnight in off-street facilities, gave an approximation as to the total number of vehicles at the start of the cordon period. This study was made in December 1947.

## Speed and Delay Studies

Vehicular speed and delay studies were made by both the California Division of Highways and the four departments. Portions of over 30 major streets were studied and the data were combined to provide figures for approximate speeds over existing city streets. These studies were made for both peak and off-peak periods of normal weekdays during the month of May 1948.

Transit travel times and speed data were made available by the Municipal Railway and were supplemented by additional running time checks made by the Technical Committee staff.

## Special Surveys

Through travel studies to determine what numbers of vehicles traveled long distances along certain important arteries and what per cent turned off after short trips were made by the Technical Committee staff on normal weekdays in May 1948 for Market, Van Ness, Post, Third, Fourth and Howard Streets.

Boarding and alighting studies of the 40 Line and H Line for a full typical day were made in connection with special transit studies.

Condition, signal, accident and traffic volume studies were made for the forty intersections with the highest accident experience during 1947. These studies were made at various times throughout the period of the survey by the committee staff.

Special condition, signal, volume, speed and accident studies were made of Market Street from 17th Street to the Embarcadero to provide a basis for a sound functional traffic plan for Market Street.

## CHAPTER II

## TRAFFICWAYS

Formulation of this highway section of the Transportation Plan has been greatly facilitated by the existence of a number of earlier plans and studies which were available for reference. Like most other American cities, San Francisco has been endeavoring from time to time to relieve its traffic problems and to this end has prepared a number of major street or highway plans and has explored the engineering aspects of specific highway projects in considerable detail. Since 1928 no less than four separate major thoroughfare plans have been proposed. The last, in 1945, was officially adopted by the City Planning Commission as a tentative part of the San Francisco Master Plan, subject to modification and extension after further study. Throughout this series of highway studies certain proposals appear and reappear with such regularity that there can be but little doubt now of their need and soundness. The inclusion of such items in the present recommended pattern has been determined, however, only after review of the basic facts involved.

Similarly, various more or less detailed investigations, route studies and preliminary plans have been prepared by the City Engineer, the City Planning Commission, the State Division of Highways, and others. All have been made available to the consultants, have been carefully considered, and have been most helpful. Consequently, few of the projects recommended herein are entirely new proposals. The formulation of this plan has consisted in large part of weighing the many previous suggestions in the light of current information on traffic requirements, present and desirable future community development, technical advances in highway design and a functionally sound overall pattern; and the selection of those projects which best satisfy all requirements. Gaps have been filled in with original proposals and all projects have been welded into a properly articulated, balanced and comprehensive system of trafficways.

Among the most important of the projects previously proposed are the plans of the State Division of Highways for the Bayshore Freeway, now reaching the construction stage; their preliminary plans for a parallel Bay Bridge and its San Francisco connections; and their preliminary studies for the northerly extension of the 13th Street approach to the Bayshore Freeway across Market Street. Other freeway possibilities had been explored by the City Engineer and the City Planning Commission along the so-called Market-Portola, the Mission and the Panhandle routes. A special report on a Marginal Freeway was prepared for the City Planning Commission in 1945 by Woodruff and Sampson, engineering consultants. All these were given careful consideration. Still other freeway proposals were being investigated by the State Division of Highways concurrently with the consultant's studies, including the southern bay crossing approaches and a marginal freeway development northward from Army Street to the vicinity of Market Street. The latter have been incorporated in the present recommendations.

None of the above studies or proposals could have been adequately analyzed and judged however, without benefit of the data on traffic origins and destinations described in Chapter I. Some projects which may have been perfectly sound from an engineering standpoint simply

could not be justified by the data thus obtained as to volumes of traffic that would use the facilities if built. It was necessary, also, to consider each previous proposal not by itself alone, but as a component part of an integrated, overall traffic handling system. When considered in such light, several of the projects had to be modified to fit with others. In addition, appropriate adjustment to present and desirable future land uses and general community development necessitated in some cases modifications in route location or in the type of highway recommended.

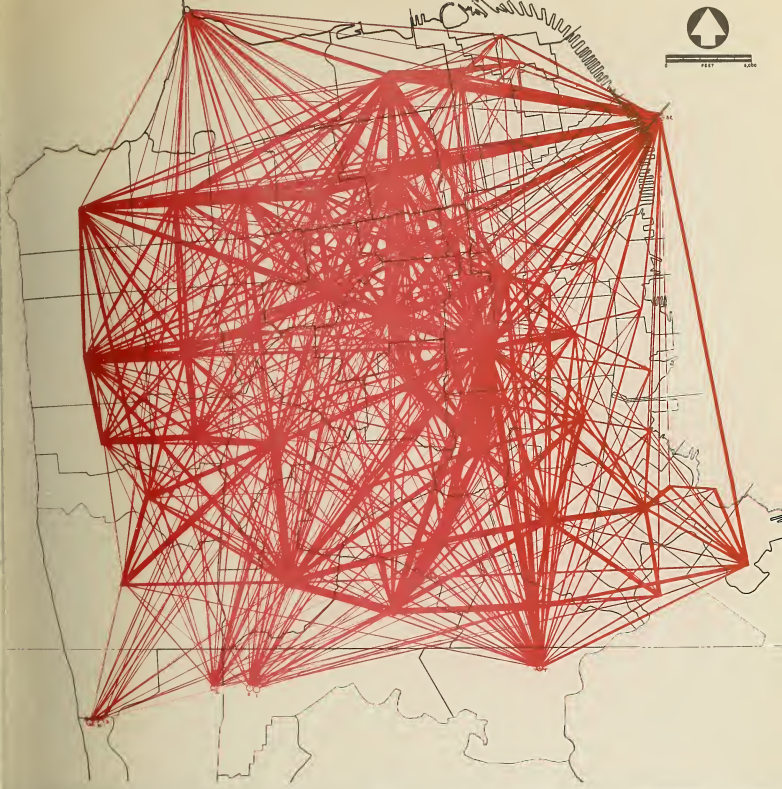
Most valuable in the preparation of the consultants' plan was the March 1947 report and interim plan prepared by the Technical Committee of the Mayor's Administrative Transportation Planning Council. With very few exceptions, the thoroughfares proposed in that plan have been verified and incorporated in one form or another in the consultants' plan. Several of the improvements recommended in the 1947 report were later approved by the voters at the bond issue election in November 1947, at which time the sum of $22,850,000 was made available for major thoroughfare projects. The city thus has made a substantial start on the solution of its current traffic problems.

## FREEWAY SYSTEM

The traffic data collected from the Bay Area Metropolitan Traffic Survey made it possible to determine where people go, the time pattern of travel, the trip purposes and the mode of transportation. Analysis of these data provided the basis for selecting route locations to serve best the traffic needs of San Francisco. From the data obtained on the several classes of traffic movement, desire lines of travel for both automobiles and trucks were determined. A desire line is defined as a straight line between the point of origin and the point of destination of a trip or a group of similar trips without regard to the routes actually traveled; in other words, the line of travel if a direct highway existed.

These lines were drawn between the Metropolitan Traffic District and all its tributary areas; between segments within the City of San Francisco exclusive of those in the Metropolitan Traffic District; and between zones wholly within the Metropolitan Traffic District. The desire line charts covering movements at 1947 traffic levels are reproduced on Plates II-1, II-2, and II-3 inclusive for automobiles, and on Plates II-4, II-5, and II-6 inclusive for trucks. Through detailed analyses of these and similar studies, major directional desire lines were developed. A composite major desire line chart showing all motor vehicular movements at 1947 traffic levels is reproduced on Plate II-7.

The bands shown on Plate II-7 do not show trip lengths, neither do they establish the exact location for major highway routes. They should not be confused with traffic flow charts which show actual or anticipated traffic on existing or proposed highway facilities. Each band is merely a grouping of the various desire lines having a like direction into a band showing the weight of that directional desire. The major directional desire lines form the basis for determination of the general location of freeways and expressways. The widths of the bands indicate the approximate volume of vehicles each route would attract. The bands are relative only and represent such trips as fall within reasonable limits along the direction of the major desire lines of travel.



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# DESIRE LINES OF AUTOMOBILE DRIVERS

## TRAVELING BETWEEN SEGMENTS OUTSIDE THE METROPOLITAN TRAFFIC DISTRICT - 1947

1 LINE = 50 AUTOS

$\frac{1}{16}$" BAND = 1800 AUTOS

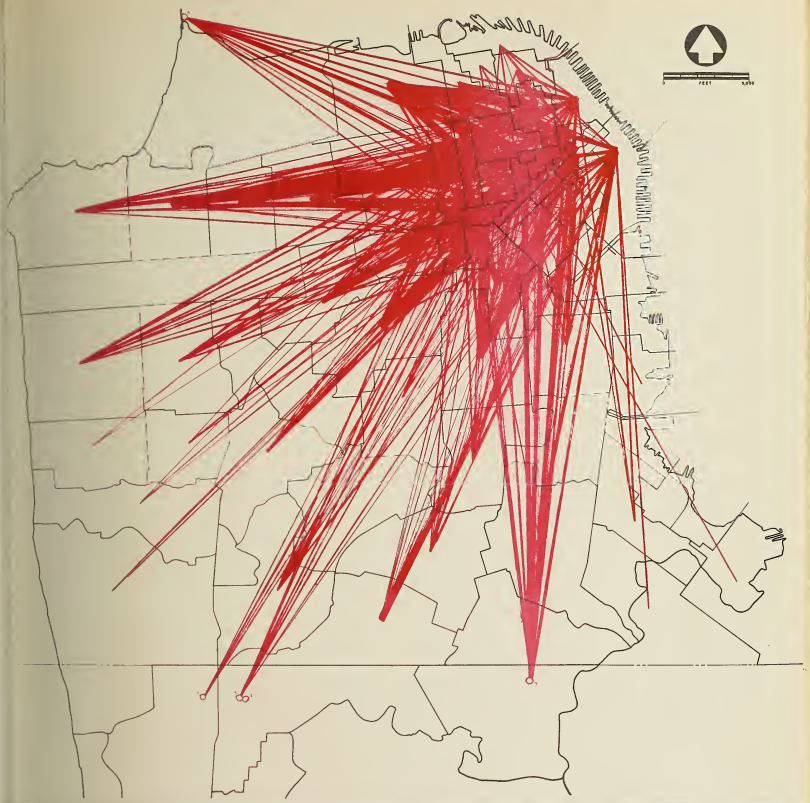
SOURCE: B.A.M.T.S. 1946-47, CALIFORNIA DIVISION OF HIGHWAYS

TRAFFICWAYS

II

1

PLATE



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# DESIRE LINES OF AUTOMOBILE DRIVERS

## TRAVELING BETWEEN THE METROPOLITAN TRAFFIC DISTRICT AND OUTSIDE SEGMENTS - 1947

1 LINE = 50 AUTOS

1/16" BAND = 1600 AUTOS

SOURCE B.A.M.T.S. 1946-47, CALIFORNIA DIVISION OF HIGHWAYS

TRAFFICWAYS

II

2

PLATE

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# DESIRE LINES OF AUTOMOBILE DRIVERS

## TRAVELING WITHIN THE METROPOLITAN TRAFFIC DISTRICT

## 1947

1 LINE = 50 AUTOS

$\frac{1}{18}$" BAND = 1600 AUTOS

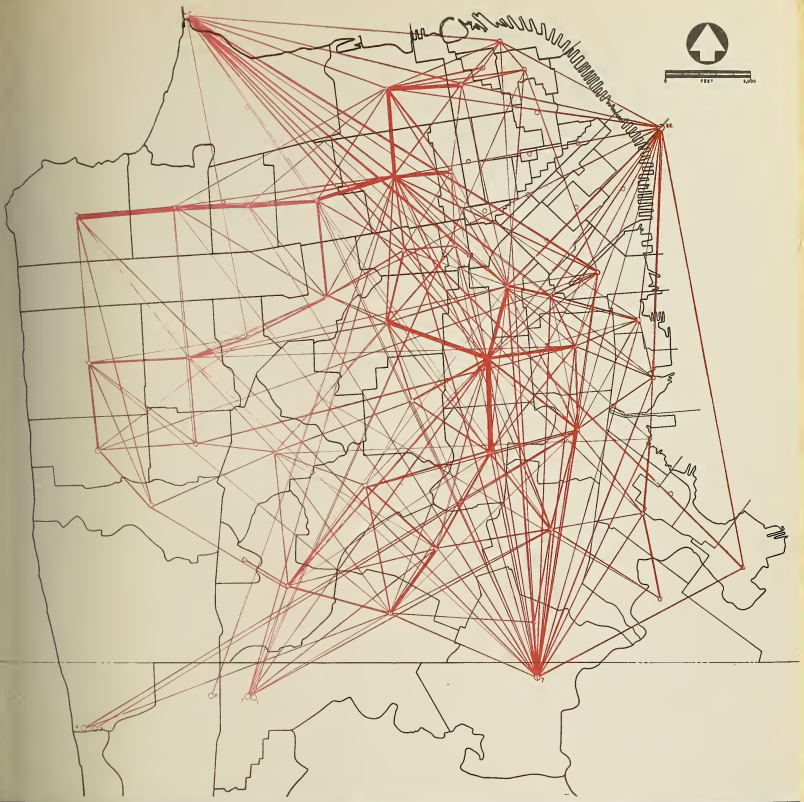
SOURCE B A M T S 1946-47, CALIFORNIA DIVISION OF HIGHWAYS

TRAFFICWAYS

II

3

PLATE



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TRAFFICWAYS

II

# DESIRE LINES OF TRUCK DRIVERS

## TRAVELING BETWEEN SEGMENTS OUTSIDE THE METROPOLITAN TRAFFIC DISTRICT — 1947

1 LINE = 50 TRUCKS

1/16" BAND = 1600 TRUCKS

SOURCE B.A.M.T.S. 1946-47, CALIFORNIA DIVISION OF HIGHWAYS

4

PLATE

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TRAFFICWAYS

II

# DESIRE LINES OF TRUCKS

## TRAVELING BETWEEN THE METROPOLITAN TRAFFIC DISTRICT AND OUTSIDE SEGMENTS - 1947

1 LINE = 50 TRUCKS

$\frac{1}{16}$" BAND = 1600 TRUCKS

SOURCE B.A.M.T.S. 1946-47, CALIFORNIA DIVISION OF HIGHWAYS

5

PLATE

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# DESIRE LINES OF TRUCK DRIVERS

## TRAVELING WITHIN THE METROPOLITAN TRAFFIC DISTRICT

## 1947

1 LINE = 50 TRUCKS

$\frac{1}{16}$" BAND = 1600 TRUCKS

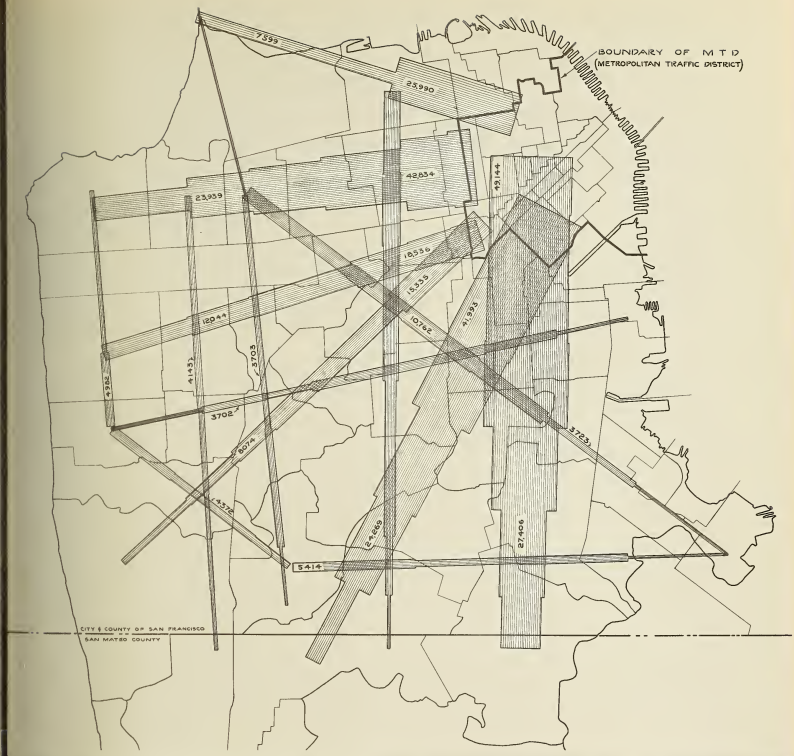
SOURCE D.A.M.T.S. 1946-47, CALIFORNIA DIVISION OF HIGHWAYS

TRAFFICWAYS

II

6

PLATE

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# MAJOR DESIRE LINES

## OF AUTOMOBILE AND TRUCK TRIPS IN SAN FRANCISCO
## 24 HOURS – NORMAL WEEKDAY – 1947

10,000
20,000
30,000
40,000
50,000
SCALE OF VEHICLES

DESIRE LINE TOTALS SHOWN INCLUDE 72.5% OF GRAND TOTAL OF ALL TRIPS. GRAND TOTAL INCLUDES ALL TRIPS WITH ORIGIN AND/OR DESTINATION IN SAN FRANCISCO EXCEPT TRIPS ENTIRELY WITHIN M.T.D. OR BAY BRIDGE CROSSINGS TO AND FROM M.T.D.

SOURCE: B.A.M.T.S. 1946-1947, CALIFORNIA DIVISION OF HIGHWAYS

TRAFFICWAYS

11

7

PLATE

The traffic analysis has shown that a number of well defined major desire lines of travel exist in San Francisco. A pattern of freeways which will form the backbone of the highway transportation network has been developed to serve present and future traffic along these travel lines. The origin-destination survey data have been used in the analysis of the proposed system of freeways to determine the particular location of the routes which will meet the needs of the greatest number of motorists and truckers. Deviations from the lines of travel shown on the major desire line chart have been required, however, by practical considerations of topography or highly developed commercial and residential areas.

General Considerations

In developing the freeway system, it was necessary to make a thorough study of existing highways in order to utilize to best advantage these facilities as feeders or supplemental routes. Each freeway route has been so located as to permit proper connections to these various surface thoroughfares.

Three of the limited access highways entering San Francisco will comprise parts of the proposed 40,000-mile network of interregional highways to serve the entire United States. This system was originally proposed by the National Inter-Regional Highway Committee in January 1944. It was approved by the several State Highway Departments and the Administrator of the Public Roads Administration, Federal Works Agency, on August 2, 1947. The recommended system is designed to fulfill the needs of interstate and intercity highway transportation essential to the economic welfare and defense of the nation. Under this program, the San Francisco area would be served by a limited access route corresponding in general location to U.S. 40 to Sacramento and by U.S. 101 extending both north and south parallel to the Coast. The rural portions of these highways will need to be improved, in many cases, so that they will conform with interstate standards of design for capacity, slight distances, grades and limitation of access.

Federal funds have been appropriated to aid in the construction of the urban portions of the interstate system and a limited mileage of other urban highways to supplement that system. To qualify for these funds, such highways must be designed and built to high standards as freeways.

Definition of "Freeway"

By "Freeway" is meant a divided highway completely cut off from adjoining property with fully controlled entrances and exits and having no cross traffic at grade, and no stopping, parking, traffic signals, left turn movements, or pedestrians. (Such a definition has recently been adopted by a Committee of the American Association of State Highway Officials). Freeways usually are in open cut or on elevated structures, sometimes at ground level with grade separations at important crossings and other cross streets closed. A freeway has the advantage over the usual type of major street of providing for uninterrupted, high speed movement with a high degree of safety and high traffic capacity. From the community development standpoint, freeways help to relieve residential and local business streets of detrimental through traffic. They can be used to separate business or industrial districts from residential areas, or to screen off railroads. When properly located they can be instrumental in defining the boundaries of residential communities and neighborhoods.

The freeway locations proposed herein have been selected not alone for their service value to major traffic movements, but also to fit into and help to further realization of the overall community Master Plan. Such factors as topography, the presence of natural open spaces, the density and quality of existing private development that would have to be cleared away, the beneficial or detrimental effect upon remaining property, the value of each route location in promoting a desirable type of community development or redevelopment, its value in shaping the city into a logical arrangement of communities and neighborhoods—all these have been given due consideration. Fortunately it was possible due to proper timing to fully coordinate the Trafficways Plan with the Master Plan of Land Uses, also currently under preparation by the Department of City Planning.

Declaration of "Freeway"

Consideration has been given to the stage development of each route. Under such a program, each unit as constructed would serve as a needed and efficient traffic artery until the balance of that route or of the system could be completed.

The locations shown for the various freeways on the plan and profile sheets appended hereto are the results of preliminary studies only. Field surveys of the individual routes required for design purposes may lead to deviations in alignments from those shown. The preliminary studies prove, however, that rights-of-way on alignments in the general locations indicated can be acquired at reasonable cost for freeways conforming with basic design standards.

Design Standards

Basic standards used in the location and design of the freeway system conform to those adopted by the American Association of State Highway Officials for the Inter-Regional Highway System except in the matter of vertical clearances in which the California standard is somewhat greater than tha prescribed. The basic standards recognize that in certain instances topography, property values, or other compelling reasons may prevent absolute adherence to the standards recommended. Otherwise these standards have been found necessary for the safe and expeditious movement of the large volumes of high speed mixed traffic anticipated.

The established criterion for urban sections of the interstate system requires that where traffic volumes are less than 20,000 vehicles daily, two lanes each 12 feet in width are required in each direction, separated by a suitable median strip or central mall. Where traffic volumes are in excess of 20,000 vehicles daily, three or more lanes in each direction are required.

In applying the limited access feature wherein the right of access is confined to designated ramps or interchanges, a wide right-of-way is highly desirable. Sufficient width should be obtained to provide ample room for pavements, shoulders, landscaped side slopes, service roads and interchange ramps. Typical cross sections illustrating these features are shown on Plate II-11.

The accepted standards for horizontal and vertical curvatures and sight distances must be adhered to in order to provide a highway which will carry safely large volumes of mixed traffic at a designed speed of 50 m.p.h. The use of spiral transitions on horizontal curves is mandatory.

Profiles of the freeways have been controlled to a great extent by topography and by existing highways and railroads to be crossed. Grades have been reduced substantially below those of parallel streets, however, by using elevated and depressed sections alternately. A maximum gradient of three per cent has been used wherever possible since this gradient can be negotiated by trucks in high gear. It has been necessary in some instances, however, to use gradients as great as 5.6 per cent for short distances on up-grades. The gradient of ramps has been held within the standards prescribed: 6 per cent for up ramps and 8 per cent for down ramps.

Special architectural treatment of all structures to make them harmonious with their surroundings is contemplated, and the cost of such treatment is included in the cost estimates. The use of retaining walls rather than side slopes will be necessary in some instances to avoid the taking of prohibitively expensive land and buildings.

Ramp connections must be provided for egress and ingress at important highways intersected. These ramps will connect to the express roadways proper by means of long acceleration and deceleration lanes. The connection of ramps to existing streets has been considered in locating ramps so that adequate provision for traffic movements can be made through channelization, one-way control, or other means.

At the intersections of freeways, interchanges are provided with full limited access characteristics. These are directional in all instances except where a minor volume of traffic is to be accommodated in which cases cloverleaf turns are sometimes applied.

The high-speed, high-capacity characteristics of freeways requires special attention to such auxiliary features as right-of-way fencing, guard rails, integral pavement markers, jumbo warning and directional signs, and roadway lighting.

Landscaping of side slopes, medial dividers and marginal strips will give the freeways a park-like appearance and muffle the hum of highway traffic. Adjacent property will be desirable for new buildings of all kinds, including residential and institutional, because of the superior transportation facilities afforded and the attractive view provided. Special landscape treatment is recommended for the large areas at interchanges and access points to prevent erosion at these locations, as well as for the aesthetic value. California is especially fortunate in the great variety of plants available for such application and the year-round growing season which will keep the freeways pleasing in appearance throughout the year. This presents an opportunity for the development of incidental improvements such as small playgrounds for children and sitting parks for older people. These facilities located in a broad attractive green strip would contribute substantially to the improvement of living conditions and values in depressed neighborhoods. These areas should be sodded and landscaped with native plant material arranged in natural groupings. The cost of such incidental improvements has been included in the estimates of cost of freeways.

Description of Freeway Routes

The three predominating flows of traffic radiating from the Metropolitan Traffic District will be accommodated on the Panhandle Freeway and its extensions to the west, the Mission Freeway to the southwest and the Bayshore Freeway to the south. See Plates II-8 (folding map) and II-9. These three great thoroughfares will be articulated by the Central Freeway which will function as a distributor and diffuser of these heavy traffic concentrations.

Two additional freeways are required to serve properly the proposed southern bay crossing. The Marginal Freeway will provide a direct route to the eastern fringe of the downtown district providing entry to that concentrated area over the lightly traveled streets

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TRAFFICWAYS II PLATE 9

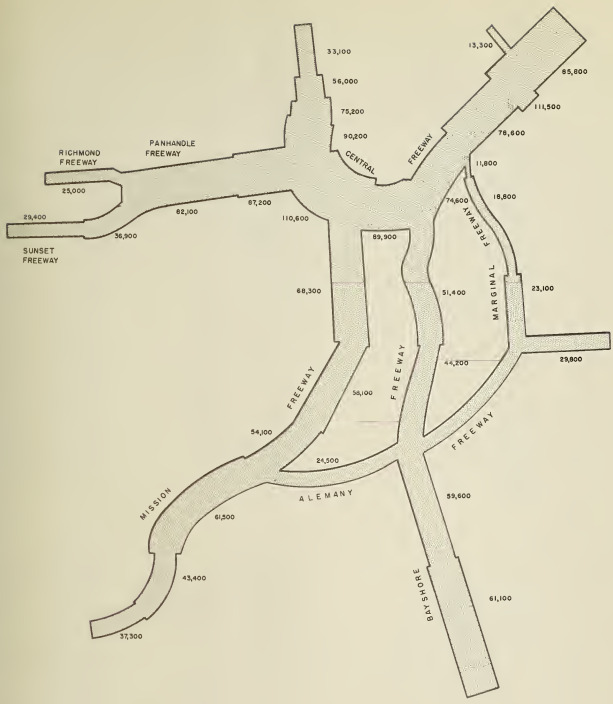
SAN FRANCISCO DEPARTMENT OF CITY PLANNING

# AIRVIEW OF CITY SHOWING TRAFFICWAYS

FREEWAYS
EXPRESSWAYS

PARKWAYS

MAJOR THOROUGHFARE
SECONDARY THOROUGHFARE

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OCTOBER 1948

# ESTIMATED MOTOR VEHICLE TRAFFIC VOLUMES ON FREEWAYS IN 1970

## 24-HOUR TWO-WAY NORMAL WEEKDAY TRAFFIC

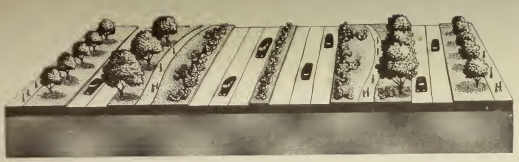
TRAFFICWAYS

11

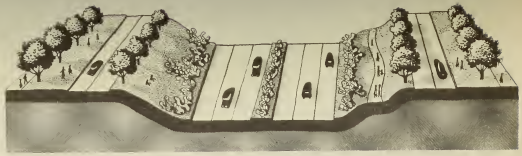
10

PLATE

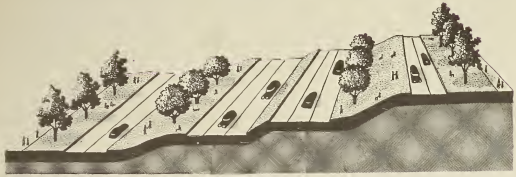
SAN FRANCISCO DEPARTMENT OF CITY PLANNING



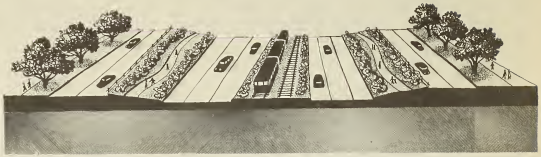
SURFACE



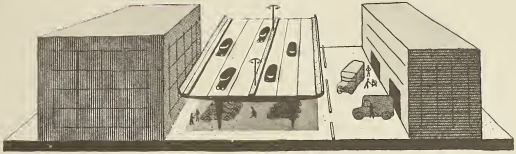
DEPRESSED



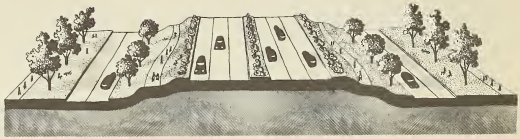
SIDE HILL



SEMI - DEPRESSED



ELEVATED STRUCTURE



ELEVATED ON FILL

11 TRAFFICWAYS

11 PLATE

# TYPICAL FREEWAY CROSS-SECTIONS

near the waterfront and relieving the thoroughfares leading to the congested downtown area from the south and the west. The Alemany Freeway provides a direct connection for vehicles destined either to the southern crossing from the south and the southwest or to the Marginal Freeway. This will reduce the traffic on the Bayshore, Mission and Central Freeways to practicable levels.

Central Freeway

This all important freeway will start at Broadway just east of Van Ness Avenue. See Plates S-1 and S-2. The roadways will be depressed from Broadway to Clay Street at which point they will be carried on an elevated structure on a right-of-way of restricted width parallel with and between Van Ness Avenue and Polk Street. A connection to a portal in the center of Van Ness Avenue north of Broadway will be made by a short tunnel. A spur between Pine and Bush Streets will accommodate traffic to and from the downtown area. This spur will take advantage of topography to reduce grades for traffic which will be delivered to the existing street system near Hyde Street.

The route will swing to the southwest in the block between Eddy and Turk Streets, crossing Van Ness Avenue and continuing to a location in the block between Gough and Octavia Streets at Fulton Street. The route then extends southward to a location just south of Market Street providing space for the necessarily elaborate interchange with the Panhandle Freeway. This entire section will be elevated - largely on solid fill with gentle side slopes which will afford an opportunity for attractive landscaping.

From this point the Central Freeway will swing easterly as an elevated structure making connections with the Mission Freeway and utilizing the right-of-way now being acquired for 13th Street between Valencia and Folsom Streets. The route will then continue to an interchange with the Bayshore Freeway south of Bryant Street and centered approximately on 9th Street. At this point the Central Freeway loses its identity as such, becoming an extension of the Bayshore Freeway to the approaches to the San Francisco Bay Bridge.

This great central artery constitutes the major feature of a grand circumferential distributor loop around the Metropolitan Traffic District. Completion of the loop involves the use of the Marginal Freeway from the bridge approaches to the vicinity of Market Street, the Embarcadero from this point to Broadway, and Broadway from The Embarcadero to Van Ness Avenue.

Normal weekday traffic on the several sections of the freeway system has been estimated at both 1947 and at 1970 traffic levels. Allocations of traffic have been made by detailed review and study of the trips between origins and destinations, at extermal points and in the numerous zones in San Francisco. These estimates are summarized in Plate II-10. The high economic value of the Central Freeway is shown by the fact that it will attract the greatest volume of traffic of any of the freeways in the system.

Bayshore Freeway

The Bayshore Freeway has now been completed through a portion of San Mateo County and is under construction in South San Francisco.

Plans for extension of the route through the city to the San Francisco Bay Bridge prescribe a route to the west of Bayview Park in the vicinity of the present Bayshore Boulevard at Third Street. From this point, the route continues northerly parallel to and on the west side of Bayshore Boulevard to Army Street. The highway will be alternately in cut and on fill to reduce the grades and provide full limited access characteristics with all cross traffic carried over or under the freeway.

The Bayshore route will cross Army Street above grade, swing to the east of San Francisco Hospital with a depressed roadway and then westward around the hill and northward in the blocks between San Bruno Avenue and Vermont Street. At Mariposa Street the highway will become an elevated structure in order to clear all the railroad spurs in the highly industrialized area from here north.

The Bayshore Freeway connects with the Central Freeway in the vicinity of 9th and Bryant Streets, as previously stated, from which point it continues on fill and viaduct to the Bay Bridge.

Mission Freeway

Traffic studies show that a second freeway will be needed to provide adequately for traffic from the south. Anticipating this situation, several agencies have studied a possible relief freeway along the route of the original Mission Road or El Camino Real. The outer portion of this route is now traversed by U.S. Highway 101 through the Daly City gateway and down the Peninsula. This is the direction which major residential growth must necessarily take in the future. The land use and population studies indicate not only a large existing population tributary to this route but one that will increase substantially in the near future.

The route here recommended for the Mission Freeway lies between Mission Street and South Van Ness Avenue and extends through the Bernal Cut and along the old right-of-way of the Southern Pacific Railroad (see Plates S-3, S-4, and S-5). Business along this rail line has been declining and portions of the line have been abandoned. The railroad right-of-way should be acquired together with sufficient adjoining property to provide a freeway right-of-way about 300 feet wide. The adjacent property is sparsely developed and its acquisition cost should be extremely low compared to any other possible route.

Through the Mission District from 16th Street to 25th Street, this freeway would be located in open cut with sloping sides just back of the Mission Street business section where residential values are comparatively low. This 250-foot wide landscaped open strip will effectively protect the remaining residential area from further business encroachment and encourage its ultimate redevelopment into modern residential neighborhoods. Acquisition of right-of-way may be planned so as to provide needed off-street parking areas for the Mission Street stores. Between 16th and 14th Streets the freeway grade would rise to an elevated structure connecting with the Central Freeway interchange north of 14th Street.

Between 25th Street and the Bernal Cut, the freeway would have a side hill location passing over Army Street and under Mission Street.

Ample interchange connections to Army Street are important to facilitate movements of traffic from the projected Southern Bay Crossing to destinations to the north conveniently reached by the Mission and Central Freeways.

Southwest of the Mission Street crossing the freeway would follow the present railroad line and grade in general being alternately in cut, to fill, or side hill sections. The project is planned with a center mall of generous width for rapid transit operation as set forth in Chapter III of this report. All of this route should be attractively landscaped and desirable views preserved. The side hill sections near Geneva Avenue have been planned on two levels to reduce costs and also to simplify the necessary rail connection into the Municipal Railway central repair shops.

West of San Jose Avenue and Alemany Boulevard, the freeway would terminate for the present with a direct connection into Alemany Boulevard and Sagamore Street. The City and State Division of Highways are planning a grade separated connection between Alemany Boulevard and Junipero Serra Boulevard. Ultimately this route may be developed as a freeway southward into San Mateo County.

Proposals to develop Alemany Boulevard into a freeway from Mission Street to San Jose Avenue, have been considered and discarded. This 100-foot thoroughfare is now lined for its entire length with relatively new and modern homes. Widening to a freeway width of 250 to 300 feet would be costly, would result in a serious loss of useful housing, and would disrupt the existing local street pattern. It should better be retained as a primary feeder for the adjacent neighborhoods and a route for short distance trips, with further parkway treatment when present through traffic has been diverted from it to the freeway.

Conversion of the railroad line into a park-like freeway should have a beneficial effect upon this section of the city. It should stimulate the opening up of desirable home sites nearby where now the land is undeveloped. Existing major streets will be relieved of through traffic and will thus become more attractive for residential use or business development, as the case may be. The freeway would be so located as to provide a logical separator between residence and business areas, or between different residential neighborhoods.

Panhandle, Richmond and Sunset Freeways

Except for one short section of the Central Freeway, the greatest need for freeway construction based on estimated traffic volumes is westward from the business district into the Richmond and Sunset Districts. Several proposals have been made heretofore for a freeway on the line of the Golden Gate Park Panhandle between Fell and Oak Streets, thence dividing into two branches on the north and south sides of Golden Gate Park, respectively. Such a freeway is sound from all viewpoints and is here recommended (see Plates S-6,S-7 and S-8). This route takes advantage of existing public open spaces west of Baker Street and the eastern part lies in the area recently declared by the Board of Supervisors to be a Redevelopment Area. At the eastern end, the Panhandle Freeway will connect into the Central Freeway by means of a complete interchange. A short distance west, it

goes into a depressed section. The grade is at or below street grade so as to preserve the park-like setting - so desirable in this area. The section through the Park Panhandle is laid out to follow present existing roadways as nearly as possible, although some widening and straightening will be necessary.

West of Stanyan Street, the Richmond and Sunset Freeways hug the park boundaries as closely as the topography and present developments permit, utilizing partly the existing right-of-way along both Fulton Street and Lincoln Way. Connections are planned to Arguello Boulevard, 8th Avenue and Park Presidio Boulevard from the Richmond Freeway with grade separations at all three locations. West of Park-Presidio Boulevard connections are made to the Fulton Street roadway and to the Park Drive. These thoroughfares are adequate to serve estimated traffic needs for a considerable period. Ultimately, however, a wider roadway will be needed, which can be provided with but little encroachment on park area.

A special layout has been planned for the Sunset Freeway in the vicinity of Kezar Stadium. The grade of the eastbound express roadway is one level below the existing park drive opposite the stadium and that of the westbound roadway one level farther down. This fits the topography, eliminates any major disturbance to present facilities and permits the construction of a special graded bus terminal loop - a necessity for expeditious handling of large crowds leaving the stadium.

A grade separated connection is planned leading to the 5th Avenue-6th Avenue expressway. This conforms to the presently planned development of this facility - the utilization of this pair of streets for one-way operation.

A second grade separation for the Sunset Freeway is planned at 19th Avenue. The project will terminate here. As in the case of the Richmond Freeway, existing facilities along Lincoln Way west of this point will be adequate for an indefinite period.

Although these freeways will occupy some park land in Golden Gate Park and the Park Panhandle, this will be compensated by the removal of heavy through traffic that now regularly uses the park drives, thus interfering with and constantly endangering the recreational users of the park. In 1945 this traffic was found to exceed 30,000 cars per day at the Main Drive entrance on Stanyan Street. Portions of the Park Panhandle that would be used for freeway construction would be more than replaced by the extension of park treatment eastward along both sides of the freeway, between Fell and Oak, to Octavia Street.

Alemany Freeway

Alemany Boulevard between Mission Street and Bayshore Boulevard has recently been improved to essentially freeway standards. Right of access to this highway has not been acquired as part of the improvement, however, and the utility of the thoroughfare may be drastically reduced during the next few years by the development of abutting property. Steps should be taken, therefore, to acquire a strip of land on each side of the highway with appropriate surface drives, if required, to restrict traffic movements to and from the highway to prescribed locations. Special facilities for pedestrians should be provided.

It is also recommended that appropriate interchanges be provided with the Mission Freeway and with the Bayshore Freeway - see Plates S-9 and S-10. This freeway should be extended at elevated grade approximately along the line of Selby Street from Bayshore Freeway to a connection both with the Marginal Freeway and with the Southern Bay Crossing.

Marginal Freeway

The Division of San Francisco Bay Toll Crossings of the State Department of Public Works has made detailed preliminary studies covering additional crossings of the bay to relieve the present peak hour congestion on the San Francisco-Oakland Bay Bridge. These cover a second bridge, parallel to the present structure, and a new crossing some distance south extending east from San Francisco at a location near Army Street. This problem will be discussed later.

A suitable connection providing for the expeditious movement of traffic from the southern crossing to the Embarcadero and downtown streets near the waterfront properly is considered as a necessary part of that project. Preliminary studies of the line and grade of this facility, which is designated as the "Marginal Freeway" have been made by the Division of Bay Toll Crossings. We have been furnished information from time to time on the several alternates considered and, therefore, have undertaken no independent studies. Two alternate routes have been developed and analyzed.

The first, with an alignment generally along the waterfront, required a high level bridge over the China Basin channel.

The second route follows Tennessee Street from Army Street northward to Mariposa Street, then extends just west of Sixth Street to a connection with the distributor loop. Direct connections to and from the east only are provided here. This is advisable because of the desirability of routing Marginal Freeway traffic to the east around the distributor loop instead of further congesting the heavily traveled westerly sections.

An extension north along the Embarcadero would consist of an elevated structure under the existing bridge approach coming to grade a short distance south of Market Street. Its extension to a point north of Market Street would be accomplished by an enlargement of the existing underpass in front of the Ferry Building.

The Sixth Street alternate route would be considerably cheaper than the waterfront route and this alignment, therefore, is recommended.

As traffic on the inner sections of the Bayshore and Mission Freeways begins to reach the inevitable saturation point, relief routes will become highly necessary. The Marginal and Alemany Freeways would handle traffic to the 3rd Street industrial district, the rail and motor freight houses, the wharves, lower Market Street and North-of-Market areas which otherwise would overload the Mission or Bayshore and the Central Freeways.

## Future Additions

Plate II-8 (folding map) indicates by dashed lines possible future additions to the network of freeways which may become necessary and desirable after 1970. It is impossible to predict at this time which of these routes will ultimately be required as full limited access highways or the order in which they should be built. Neither is it feasible to select the exact location for these routes, nor to estimate their cost. The alignments shown are principally functional rather than specific as to the most desirable location for the routes.

## Traffic Estimates

The volume of traffic on the proposed freeway system will increase considerably during the life of the structures over that estimated on the basis of 1947 O-D survey. It is important to know the character of this trend to preclude any possibility that the highways will be either over-designed or under-designed. Projections of future traffic have been carried to the year 1970.

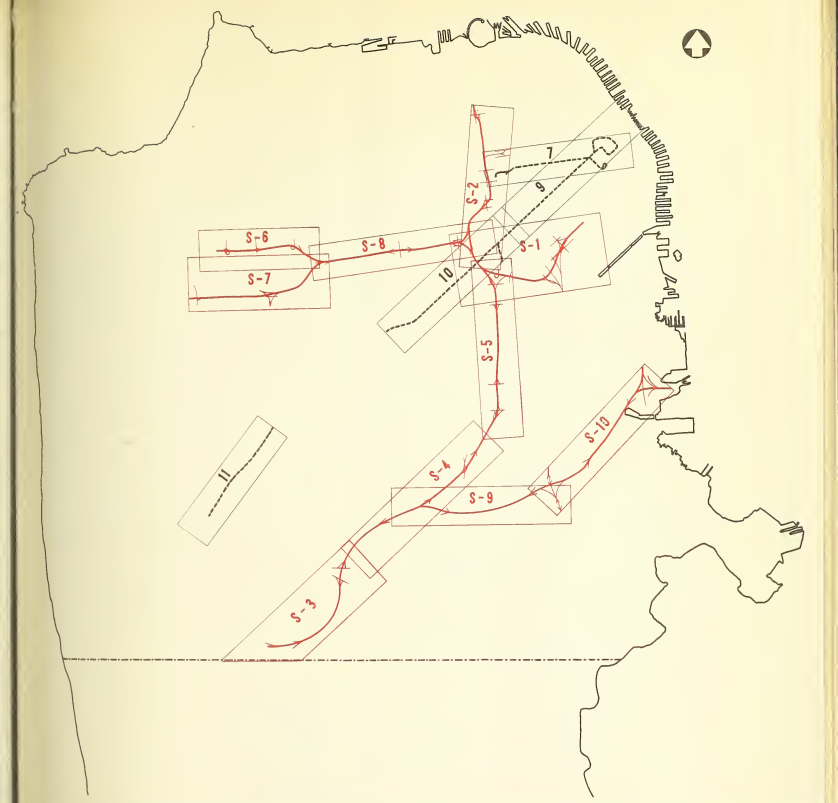
Many factors have been taken into consideration in expanding 1947 traffic volumes to 1970 levels, including population growth, increase in vehicle registration, possible decentralization, improvements in the transit system, and limitations of street capacity and parking facilities in the Metropolitan Traffic District.

The population of San Francisco proper is estimated to increase about 12 per cent between 1947 and 1970. Population changes in the sections served by the individual freeway routes may deviate widely from the overall figure, however. Greater increases will occur in the contiguous portion of the metropolitan area beyond the south city limits and across the bay. The 1970 population potential of each of the survey segments both in the city and in the area beyond has been carefully estimated -- in the city by the Department of City Planning and in the suburban areas by the local planning departments on the basis of availability of building sites, present trends, known plans for industrial expansion, and other pertinent factors. This study has been invaluable to the consultants in their effort to assign future traffic to each of the freeway routes.

In assigning traffic to the different sections of the freeway system, it was assumed that the proposed routes would be used whenever time would be saved in doing so, even though the distance was somewhat longer. At the same time, consideration was given to the continued use of good streets and the use of the surface thoroughfares recommended for improvement.

The accompanying flow map (Plate II-10a) shows estimated volumes of traffic which would use the proposed system of freeways at the estimated 1970 traffic levels.

Plate II-10b shows the estimated 1970 two-way movements of traffic on each section of the freeway system and on each pair of access ramps. It is on the basis of such information that the recommended priority of construction has been prepared and the number of lanes to be provided in each section has been determined.

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OCTOBER 1948

TRAFFICWAYS

II

# KEY MAP TO FREEWAY AND SUBWAY STRIP MAPS

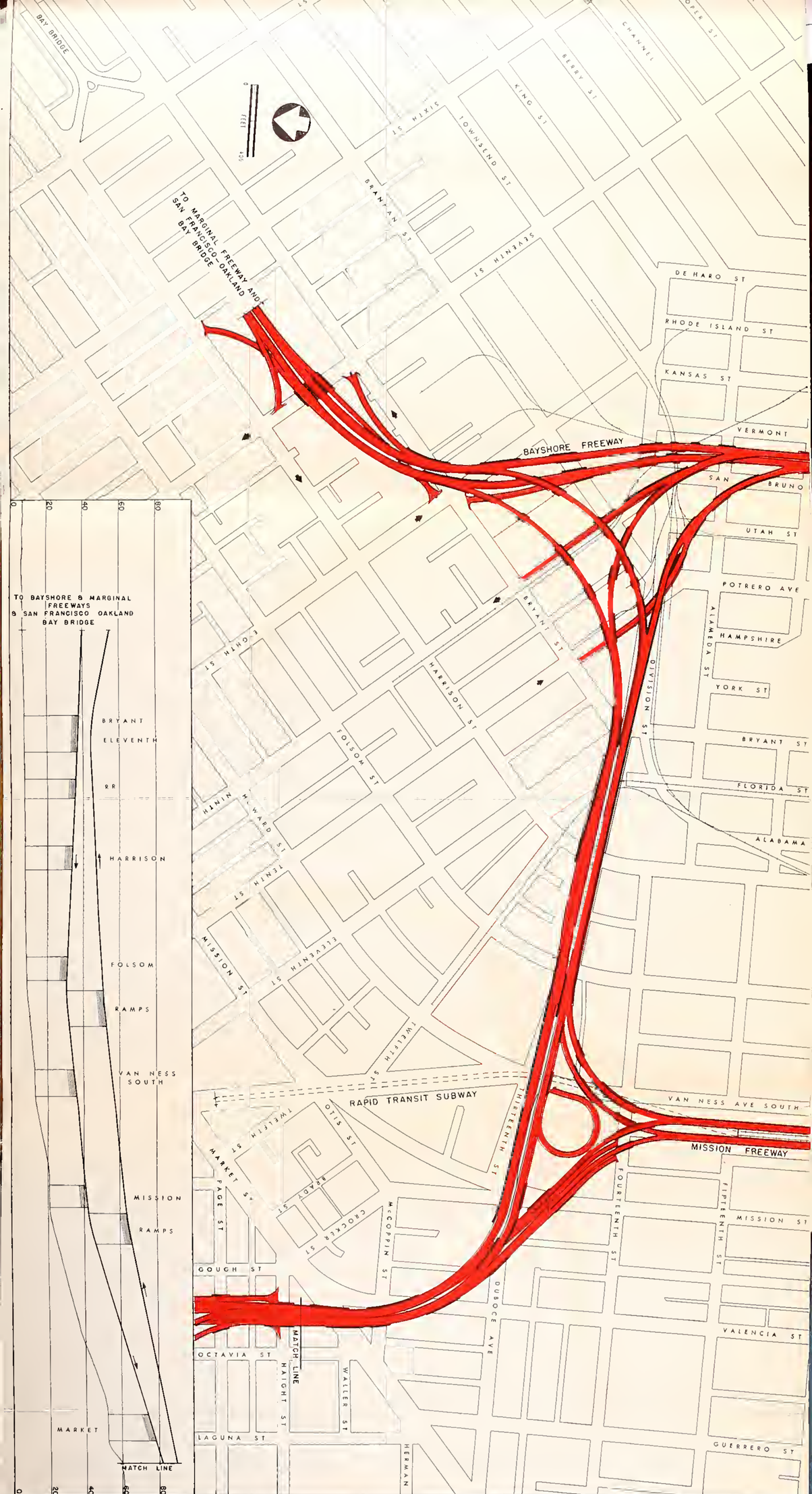
FREEWAY STRIP MAPS

SUBWAY STRIP MAPS

12

PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

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TRAFFICWAYS

11

S-1

PLATE

# CENTRAL FREEWAY

## SOUTH SECTION • BAYSHORE FREEWAY TO MARKET STREET WITH CONNECTION TO MISSION FREEWAY

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TRAFFICWAYS

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S-2

PLATE

# CENTRAL FREEWAY

## NORTH SECTION - MARKET STREET TO BROADWAY
## CONNECTIONS TO PANHANDLE FREEWAY

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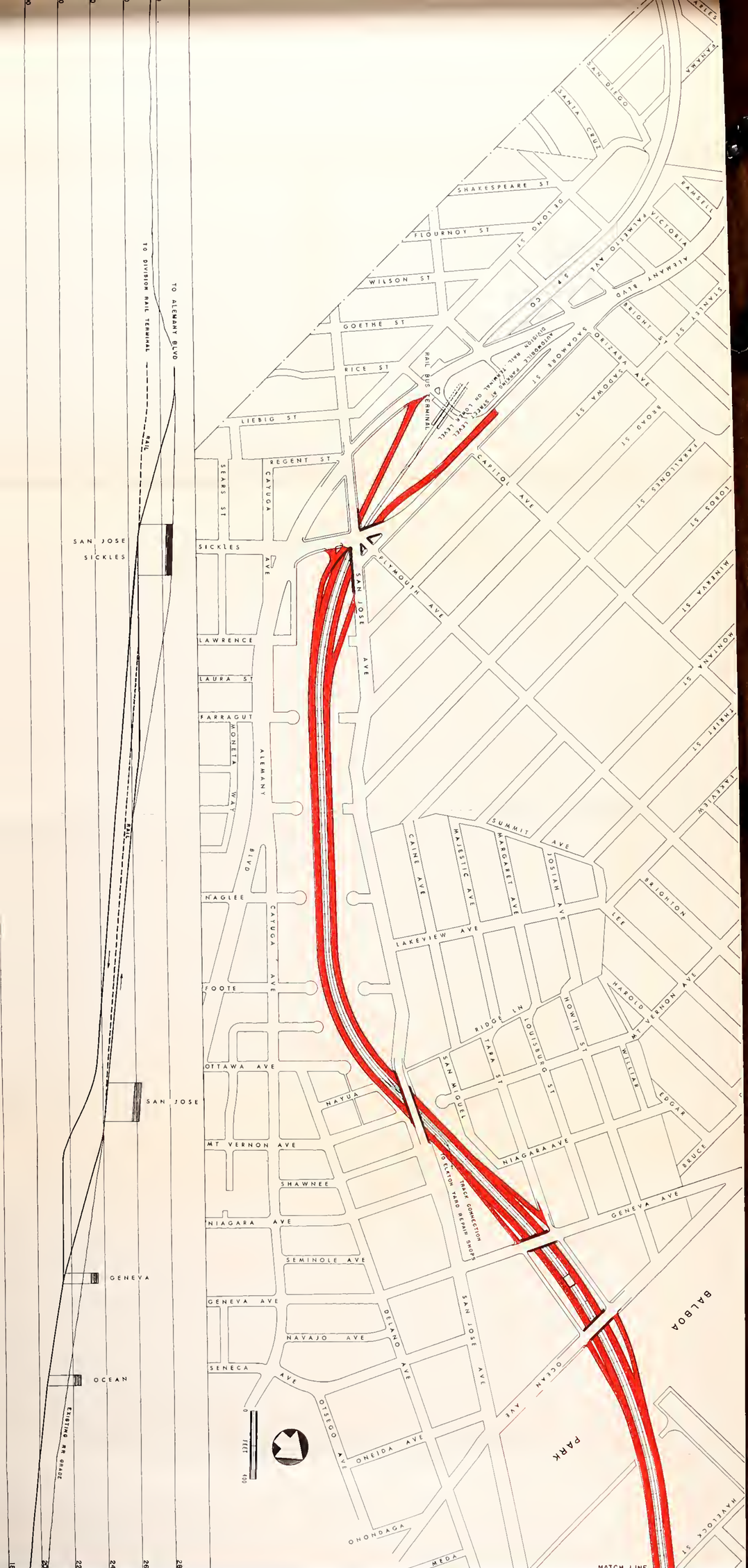


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TRAFFICWAYS

II

S-3

PLATE

# MISSION FREEWAY

## SOUTH SECTION ALEMANY BLVD. TO HAVELOCK ST.

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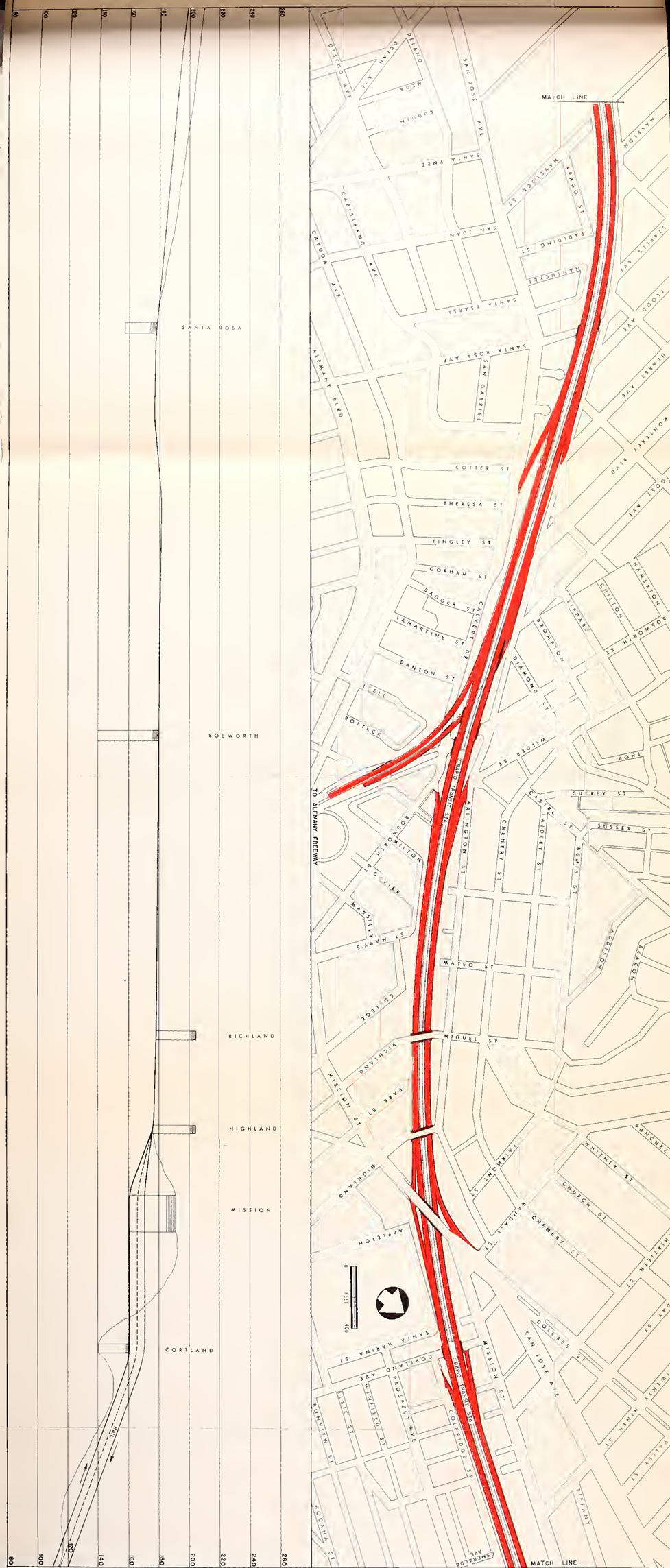


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TRAFFICWAYS

II

S-4

PLATE

# MISSION FREEWAY

CENTRAL SECTION HAVELOCK ST. TO ESMERALDA AVE.

CONNECTION TO ALEMANY FREEWAY

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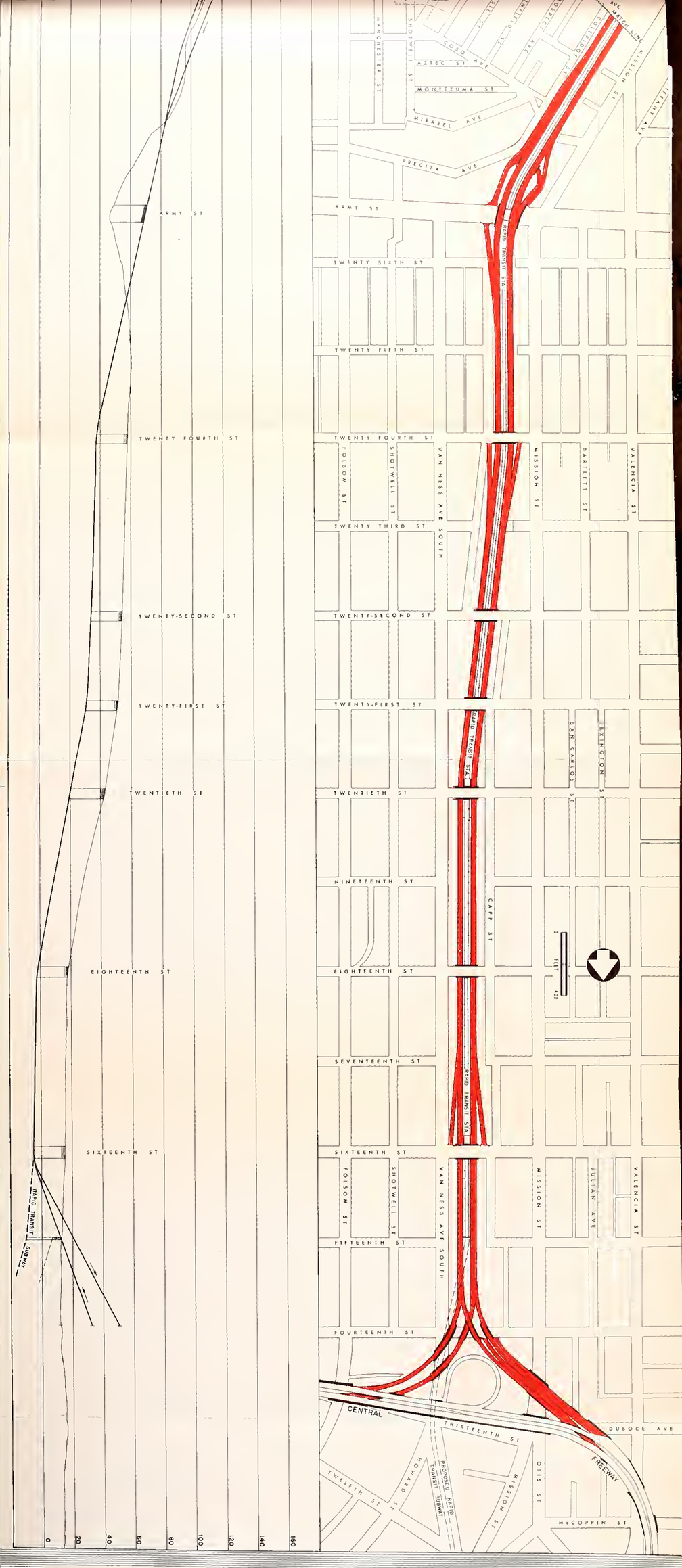


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TRAFFICWAYS
II

S-5
PLATE

# MISSION FREEWAY

NORTH SECTION ESMERALDA AVE. TO CENTRAL FREEWAY

OCTOBER 1948

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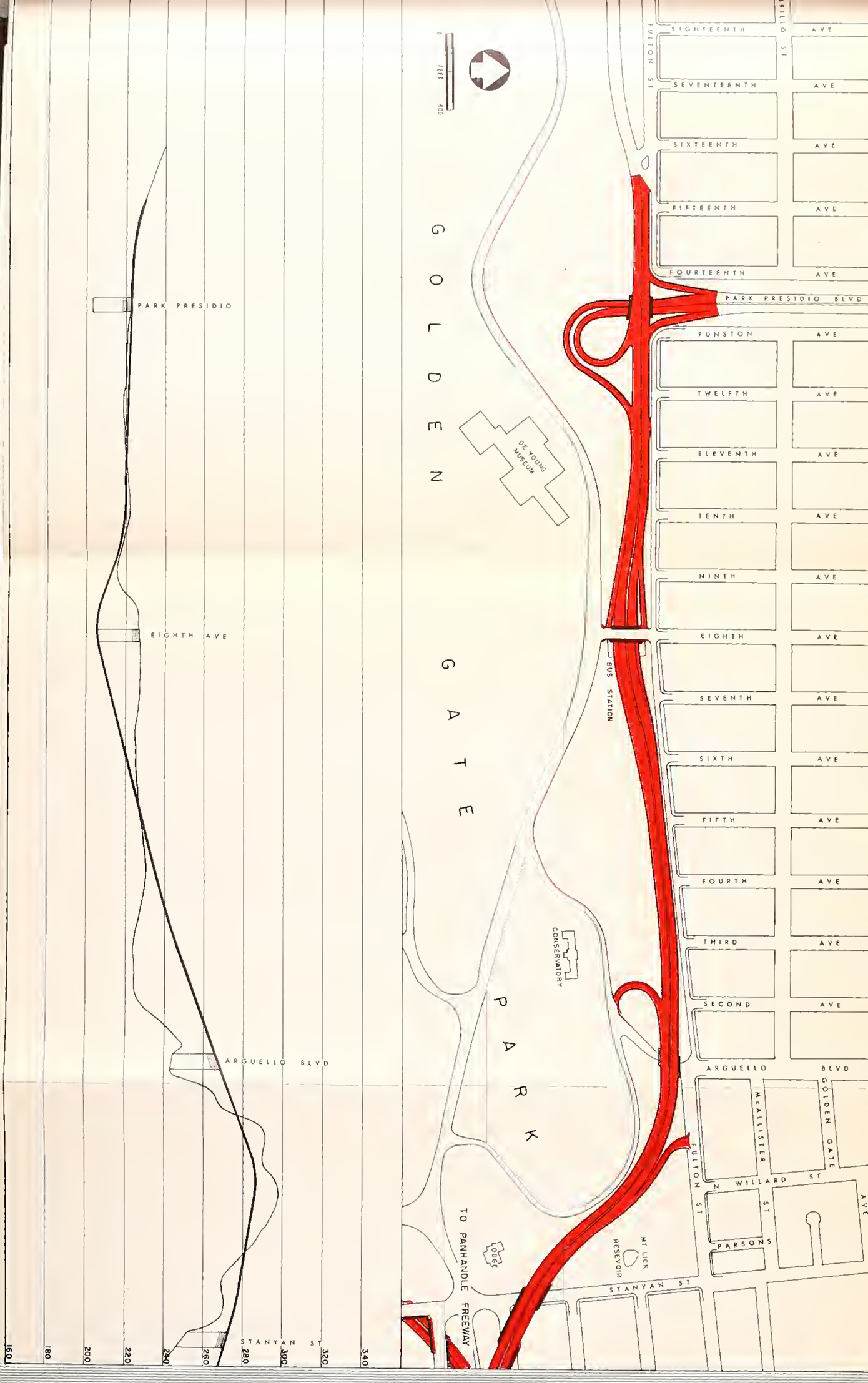


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TRAFFICWAYS

II

S-6

PLATE

# RICHMOND FREEWAY

## PARK-PRESIDIO BLVD. TO PANHANDLE FREEWAY

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# SUNSET FREEWAY

## NINETEENTH AVE. PANHANDLE FREEWAY

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TRAFFICWAYS II

S-7 PLATE

GOLDEN GATE PARK

MUSEUM

MUSIC CONCOURSE

NURSERY

CHILDREN'S PLAYGROUND

KEZAR STADIUM

RICHMOND FREEWAY

0 FEET 400

LINCOLN WAY

IRVING ST

TWENTY-SECOND

TWENTY-FIRST AVE

TWENTIETH AVE

NINETEENTH AVE

EIGHTEENTH AVE

SEVENTEENTH AVE

SIXTEENTH AVE

FIFTEENTH AVE

FOURTEENTH AVE

FUNSTON AVE

TWELFTH AVE

ELEVENTH AVE

TENTH AVE

NINTH AVE

EIGHTH AVE

SEVENTH AVE

HUGO ST

SIXTH AVE

FIFTH AVE

FOURTH AVE

THIRD AVE

SECOND AVE

ARGUELLO BLVD

FELL ST

OAK ST

PANHANDLE

PAGE ST

HAIGHT ST

WALLER ST

BEULAH ST

SHRADER ST

FREDERICK ST

CARL ST

HILLWAY

PARNASSUS AVE

WILLARD ST

STANYAN ST

PEDESTRIAN OVERPASS

UNDERPASS

OVERPASS

KEZAR DRIVE

BOTTOM OF SLOPE

280

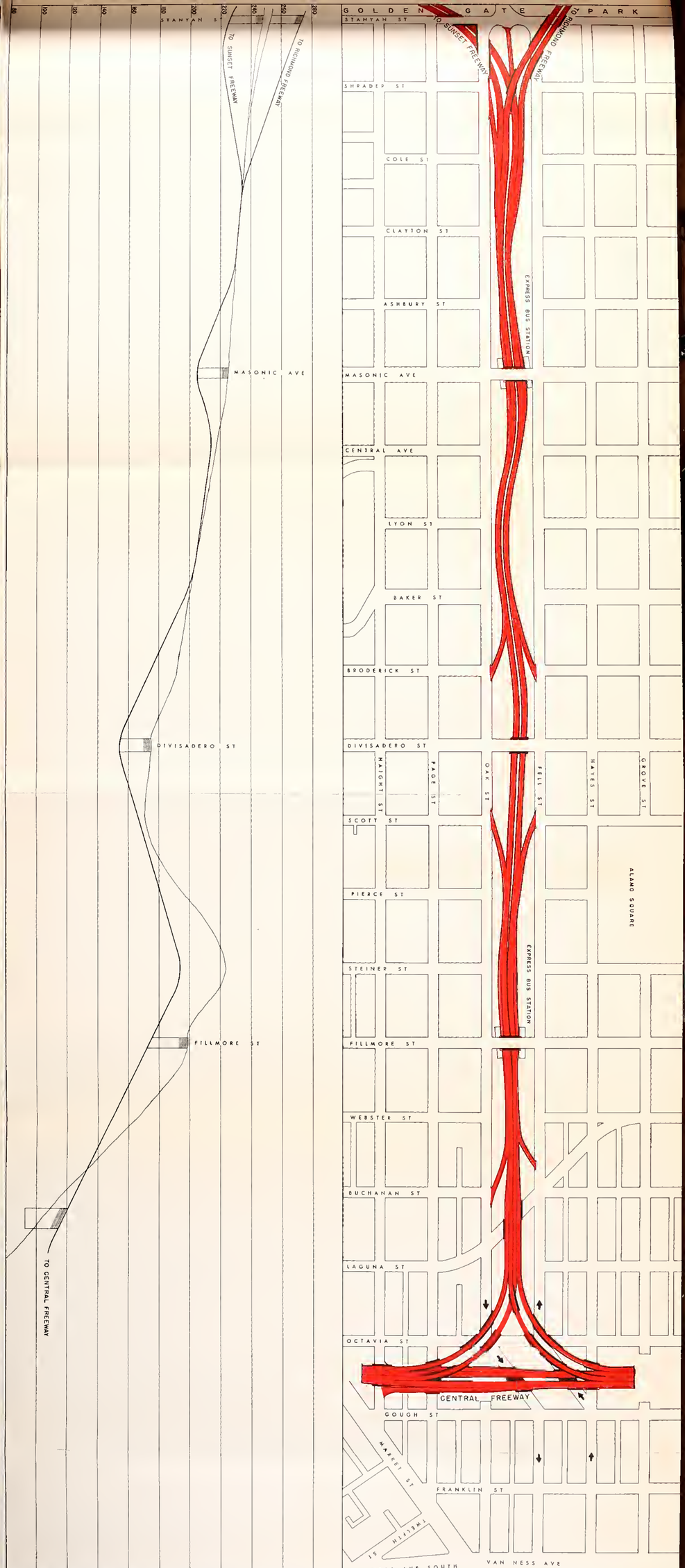
260

240

220

200

180

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TRAFFICWAYS

II

S-8

PLATE

# PANHANDLE FREEWAY

## COLDEN GATE PARK TO CENTRAL FREEWAY

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TRAFFICWAYS

II

S-9

PLATE

# ALEMANY FREEWAY

## WEST SECTION MISSION FREEWAY TO BARNEVELD AVE.

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TRAFFICWAYS

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S-10

PLATE

# ALEMANY FREEWAY

## EAST SECTION BARNEVELD AVE. TO 26TH ST.

OCTOBER 1948

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## EXPRESSWAYS

Traffic volumes of about 15,000 to 20,000 cars per day on main through routes call for something less than full freeways but more than the usual major streets. Certain existing trafficways, especially in the outlying areas, could be readily developed into what is known as an expressway. An expressway is a thoroughfare providing for faster and safer than normal traffic movement and for greater capacity by means of special traffic control, grade separations at main cross thoroughfares, reduction in the number of cross streets, and other devices. Several such routes are recommended as extensions of and additions to the freeway system where the existing or anticipated traffic volumes would not justify full freeway construction.

### Fulton Street

With the elimination of street car operation from Fulton Street, this thoroughfare can accommodate its estimated traffic without roadway widening for a considerable period in the future. When additional capacity is required, it is recommended that the roadway be widened by taking a narrow strip of land from the park and constructing a modern divided roadway west of Park-Presidio Boulevard. This will constitute an extension of the Richmond Freeway. Grade separations may be required eventually at 25th and 40th Avenues.

### Lincoln Way

Expressway development similar to that proposed for Fulton Street is recommended ultimately for Lincoln Way west of 19th Avenue. This will serve as an extension of the Sunset Freeway providing excellent connections to Sunset Boulevard and the Great Highway. A grade separation ultimately may be required at the Great Highway to avoid traffic delays. An improved interchange may also be required at the existing Sunset Boulevard separation to facilitate turning movements between east and south.

### Sunset Boulevard

This existing parkway may easily be transformed into an expressway by separating grades at important cross thoroughfares and by closing unimportant intermediate streets. No land acquisition will be necessary. There are existing grade separations at Lincoln Way and Sloat Boulevard. The route will have an increasingly important function as a collector of traffic from the western part of the Sunset and the Lake Merced areas, now rapidly building up, destined for the downtown district by way of the Panhandle Freeway. Expressway treatment of this boulevard may be undertaken in easy stages, the initial steps being the installation of synchronized progressive traffic signals and the closing of the less important cross streets.

### Great Highway

This broad divided highway along the Ocean Beach extends without intersections or cross traffic, except for pedestrians, from Lincoln Way to Sloat Boulevard, a distance of nearly two miles. Intermediate exits and entrances are suggested at Noriega and Taraval Streets to provide ultimately for grade separated interchanges. This expressway will become more useful as an outlet for Skyline Boulevard with the anticipated residential development in the areas south of Lake Merced.

Circumferential Expressway

The origin-destination survey revealed that there is considerable traffic which could be attracted to a circumferential route connecting the various outlying parts of the city. For lack of a good continuous route, much of this traffic passes through the congested central area. The 7th Avenue-Woodside-O'Shaughnessy route offers almost a ready-made channel for an express trafficway because of the topography and absence of marginal development along one side or both. This route should be connected directly into the Alemany Freeway south of the Mission Freeway by way of Bosworth Street. Eventually it should be extended across Golden Gate Park to Park Presidio Boulevard for access to the Richmond District and the Golden Gate Bridge. Woodside Avenue can be widened on the north side on undeveloped city property and the jog at Dewey Boulevard should be corrected. A grade separation at Portola Drive, widening curves along O'Shaughnessy Boulevard and installation of median strips may be required to accommodate increasing traffic volume.

This is another expressway capable of achievement in easy stages. The first and most important step is the acquisition of necessary rights-of-way and access rights to all remaining undeveloped private property along the route. This should be done immediately to forestall private encroachments which would deprive this thoroughfare of its expressway characteristics. Much of the adjoining land is already city owned.

Park Presidio Boulevard

This is an important link in the proposed system of major trafficways. It carries heavy rush hour weekend traffic to and from the Golden Gate Bridge, and through the Presidio to the Marina and North Beach Districts. It should be widened to provide three lanes in each direction, grade separations should be built at California, Geary and Balboa Streets, and the intervening minor street crossings should be closed.

Geary Street

This is the principal direct thoroughfare between the Richmond District and the Central Business District. West of Presidio Avenue it is 125 feet wide and should be streamlined, after car track removal, into a high-capacity trafficway. Installation of progressive traffic signals and a semi-continuous traffic divider, and closing of unimportant local street crossings, are recommended.

East of Presidio Avenue, where the street width decreases to 68.75 feet, improvements are now being made which will channel traffic into O'Farrell and Post Streets, recommended for one-way operation. However, when the Western Addition is redeveloped along modern neighborhood lines, the use of both O'Farrell and Post Streets will have to be discontinued for through traffic. Therefore, as a permanent solution, it is recommended that Geary Street be widened from Presidio Avenue to Gough Street to provide for two divided roadways for through traffic with service drives on either side. Local streets would connect with these service drives only. The through

roadways could be cut through the hilltop between Laguna and Gough Streets and connected by diagonals into O'Farrell and Post Streets at Franklin Street.

Broadway

This thoroughfare should be developed as an expressway from Van Ness Avenue to The Embarcadero. Completion of the distributor loop around the Central Business District involves the use of Broadway on the north, and part of The Embarcadero on the east. Construction of the Broadway Tunnel under Russian Hill has been authorized and financed. East and west of the tunnel some widening of Broadway may be necessary to accommodate the traffic that will wish to use the tunnel. A grade separation may be required eventually at Columbus Avenue. From Stockton Street eastward, Broadway will function as a distributor street.

## OTHER MAJOR THOROUGHFARES

No pattern of freeways and expressways can be expected to carry all through traffic in any city. Freeways need feeders and distributors. Some sections of the city too far removed from freeways will have to depend on surface thoroughfares. Few trips of less than two miles can be made along freeways and must of necessity use the surface street system which will require numerous improvements to function effectively.

During the past several years there have been a number of noteworthy improvements in the major street system. Nineteenth Avenue has been widened and modernized; Lombard Street has been given similar treatment; the Guerrero and Third Street improvements have virtually been completed; the long discussed Clipper Street extension has been finished; the Persia Avenue and Geneva Avenue cut-offs are now in use. Other improvements have been programmed for construction during the next three or four years.

Nevertheless, additional improvements are needed to provide for a fully coordinated and balanced system of thoroughfares adequate to meet the needs of San Francisco during the foreseeable future. Many of these have been suggested by others heretofore. They should all be coordinated along with other improvements over the next twenty years in accordance with need and with related freeway construction and redevelopment projects.

The projects in this group fall into three categories:

(a) Major Thoroughfares

(b) Secondary Thoroughfares

(c) Parkways

Major Thoroughfares are such traffic streets as Third Street which provide a continuous route for large volumes of mixed short haul traffic. They may carry four or six lanes of traffic including trunk transit lines. Usually they serve important business centers or industrial areas.

Secondary Thoroughfares are of less width, continuity and importance but are required for general traffic movements of more than purely local character. Four lanes for moving traffic usually are sufficient.

Parkways are roads through landscaped areas, restricted to passenger vehicles only. Otherwise they serve the same purposes as major thoroughfares.

Short collectors and distributors within neighborhoods and certain business or industrial access thoroughfares, are matters of detailed community planning beyond the scope of this report. Mission Street, for example, from 13th to Army, is not included in this city-wide system of trafficways although it does carry much local traffic incidental to the business district through which it passes.

In selecting the major streets to complete this system of trafficways, certain planning factors were considered, such as:

The proposed system of neighborhoods and communities with their schools, playgrounds and service centers.

Existing major traffic routes.

Topography.

Traffic origins and destinations.

Existing and proposed land uses - especially major employment centers, institutuons, dense apartment districts, and other traffic generators.

Proposed plans for redeveloping blighted areas, or for new developments on vacant lands, and

Costs.

Inspection of the figures showing relation of the trafficway plan to the proposed community and neighborhood organization of the city to land uses and to traffic generators will show how these considerations have been met. Comments on the more significant recommendations follow.

Broadway

The Broadway Tunnel is about to be constructed by the city at a cost of $5,000,000. In order that this improvement may be utilized to its full advantage, it is recommended that Broadway be improved and extended westward as a major through route serving Pacific Heights and the north side of the entire Richmond District. Such an improvement has been studied and proposed several times in the past. It should now be placed high on the priority program. The work to be done consists of a diagonal connection to Pacific Avenue at Steiner Street and back again at Divisadero, to avoid some excessive grades, and an extension from Lyon Street westward within and along the south edge of the Presidio to a connection with El Camino del Mar. Through the Presidio

the route can be of parkway design with points of access limited to Presidio Avenue, Arguello Boulevard, Park Presidio Boulevard and 25th Avenue. Right-of-way through the Presidio grounds would require government approval but should be of advantage if the War Department proceeds with any large scale development in this part of the reservation.

Market-Portola Route

Much consideration has been given to a plan for constructing a freeway along the east slope of Twin Peaks and widening Portola Drive to 120 feet through St. Francis Wood at a cost which has been estimated at more than $6,000,000. The improvement of this route on such a scale is held to be inadvisable for the following reasons:

It would tend to depreciate some of the best housing in San Francisco.

It would separate related community facilities in the West Portal district and would cut this homogeneous residential section in two.

It would deliver more traffic to Market Street which should be reserved primarily for public transit service.

Extension of the route as a freeway into the central district would involve an enormous expenditure.

A satisfactory interchange between such a freeway extension and the Central Freeway would be virtually impossible because of the limited space between the Mission and Panhandle interchanges, and finally

The cost of such an expensive improvement is not justified by the traffic it would carry.

Nevertheless, improvement of the Market-Portola route is recommended, but on a modest scale. It is recommended that Portola Drive be improved only to such extent as necessary to provide two traffic lanes in each direction separated by a narrow median strip. This can be done within the limits of the existing 70-foot right-of-way. The present excessive pavement crown should be corrected and right-of-way purchased where necessary to ease the sharp curves and increase the capacity of upper Market Street.

Marina Boulevard and Lombard Street

The present Master Plan includes a Shoreline Drive along Marina Boulevard, around Fort Mason and Aquatic Park to the Embarcadero at Fisherman's Wharf. There is already a connection to this route from the Golden Gate Bridge Freeway at Lyon Street. If this route were to be used by passenger cars, and trucks are confined to Lombard Street, there may be no need for major improvement of the latter thoroughfare for years to come. Traffic along Lombard could be speeded up and

capacity and safety increased by extending the dividing center strips across several local street crossings, removing signals at such points and retiming the remainder.

Army-Clipper

Clipper Street has been extended recently to Portola Drive, and Army Street is being widened east of Guerrero. They should be tied together by a diagonal connection in the vicinity of Castro Street to fit in with the neighborhood unit pattern and this is recommended.

Van Ness Avenue

This spacious thoroughfare will continue to serve as a distributor for traffic in and out of the west side of the business district. The proposals for redevelopment of the Western Addition will eliminate or partly close off all east and west streets in the area west of Van Ness Avenue, between Market and California Streets, except California, Geary, McAllister, Fell and Oak Streets. Van Ness will therefore become the header street for all streets to the east. With the removal of the car tracks, the roadway can be remodeled to perform its distributor function more effectively. A center mall should be provided with special turnout lanes for vehicles making left turns. North of California Street this divider may be extended across minor street intersections to minimize interference with movements along Van Ness Avenue and the signals retimed accordingly.

19th Avenue

When street car operation is discontinued south of Eucalyptus Drive, the track area should be landscaped to provide a wide center mall to function as a traffic separator. Occasional openings should be made for left turns and U-turns. North of Sloat Boulevard, the present thoroughfare could be further streamlined by extending the dividing center strip across unimportant street intersections, removing signals at these points, and retiming those that remain. A grade separation at the Sunset Freeway is recommended as a part of that project.

Webster Street

Widening of this street and its connection with Laguna and Guerrero Streets has been proposed in the plans for the redevelopment of the Western Addition. It will provide a route for local crosstown movement between the Mission and Fillmore districts without encountering the Fillmore Street business congestion. Conversely, it will relieve this business section of unwanted through traffic. Most of the right-of-way can be set aside from the land to be cleared for redevelopment.

Divisadero-Scott

There is need for a well defined continuous trafficway between the Western Addition and Marina districts, about a mile west of Van Ness. The easiest grades down the Pacific Heights escarpment are found on Scott Street. A short diagonal to Divisadero at Alta Plaza will provide a through route all the way from Marina Boulevard to Army Street at a minimum cost.

Alemany

Construction of the Mission Freeway will divert most of the through traffic from Alemany Boulevard, between Mission Street and San Jose Avenue. It could be converted into an attractive boulevard by installation of a 20-foot landscaped central mall.

Other Routes

Several other thoroughfare improvements, requiring no special comment, are included in the accompanying tabulation and are shown on Plate II-8 (folding map).

## MAJOR THOROUGHFARE IMPROVEMENTS NOW AUTHORIZED AND PROGRAMMED

(Including only those on the recommended Trafficways System)

| Major Thoroughfare | Description |
|---|---|
| 13th and Division Streets | Widening and opening through from 9th Street to Duboce Street. |
| Army Street | Widening, Bryant Street to Guerrero Street. |
| Bryant Street | Viaduct, 1st Street to Beale Street. |
| Masonic Avenue | Extension, Geary Street to Euclid Avenue. |
| Guerrero Street-San Jose Avenue | Widening, Army Street to Randall Street. |
| Seventh Street | Extension, Market Street to McAllister Street. |
| Third Street | New Bridge at Islais Creek. |
| El Camino Del Mar | Reconstructing slide area. |
| Monterey Boulevard | Pavement widening. |
| Alemany Boulevard | Overpass at Junipero Serra Boulevard. |
| Stanley Drive | Grade Separation at Junipero Serra Boulevard and extension to Alemany Boulevard. |
| Mission Street | Viaduct reconstruction at Alemany Boulevard. |
| Third Street | Streamlining, Channel to Mariposa Street. |
| Post Street-Geary Street | Diagonal connection near Presidio Avenue. |

# MAJOR THOROUGHFARE IMPROVEMENTS
## NOW UNDERWAY AND PLANNED

Immediate only shown on the recommended Thirtieth Street

| Major Thoroughfare | Description |
| --- | --- |
| Fox and Division Streets | Widening and signalization through [illegible] |
| Main Street | Widening, Turner Street to [illegible] |
| Grant Street | Widening, 1st Street to [illegible] |
| Lincoln Street | Widening, Cherry Street to [illegible] |
| Veterans Memorial Civic Center | Widening, Cherry Street to [illegible] |
| Cherry Street | Widening, Veterans Memorial to [illegible] |
| Lake Street | New Bridge at County Creek |
| [illegible] Bay Way | Reconstruction with [illegible] |
| Highway Beautification | Planting [illegible] |
| County Road Improvement | Planting at Interchange Ramps [illegible] |
| Marine Drive | Grade Separation at Jackson, Bridge Construction at Washington, Bridge at Division |
| Jackson Street | Widening [illegible] |
| Grand Street | Improvement [illegible] |
| 1st Street-Cherry Street | Signalized Intersection Improvements |

SUMMARY OF

RECOMMENDED MAJOR THOROUGHFARE IMPROVEMENTS

| Major Thoroughfare | Description |
|---|---|
| Army Street-Clipper Street | Diagonal connection near Castro Street. |
| Oak Street-Fell Street | Diagonal connection at Gough Street, in connection with freeway interchange. |
| Fell Street-Hayes Street | Diagonal connection at Gough Street, in connection with freeway interchange. |
| Broadway | Diagonal to Pacific Avenue at Steiner Street, Pacific Avenue widening and diagonal to Broadway at Divisadero Street (see Text). |
| Broadway Extension | Parkway through the Presidio, Lyon Street to El Camino del Mar (see Text). |
| Masonic Avenue | Connection to Broadway Extension. |
| Masonic Avenue-Ashbury Street | Diagonal connection near Waller Street. |
| Lombard Street | Additional streamlining west of Van Ness Avenue (see Text). |
| Market Street-Portola Drive | Straightening and pavement widening (see Text). |
| Van Ness Avenue | Streamlining (see Text). |
| 7th Street and 16th Street | Extension to Mariposa Street. |
| El Camino del Mar | Direct connection with Great Highway at Sutro Baths. |
| 19th Avenue | Streamlining (see Text). |
| Fulton Street-McAllister Street | Diagonal connection at Masonic Avenue |
| Geary Boulevard | Streamlining west of Presidio Avenue (see Text). |
| Geneva Avenue | Extension from San Jose Avenue to Ocean Avenue (coincident with Mission Freeway) and eventual widening to four lanes of traffic throughout. |

# ENCYCLOPEDIA NATIONALE TOPONYMIQUE INTERNATIONALE

| Major Thoroughfare | Explanation |
| --- | --- |
| Camp Street-Allée Street | Imaginary boundary line between streets. |
| Oak Street-Fell Street | Diagonal intersection at Angle Square, in association with Fremont Intersection. |
| Pell Street-Bates Street | Diagonal intersection at Angle Square, in association with Fremont Intersection. |
| Broadway | Diagonal to Perkins Avenue at Theater Street, Perkins Avenue Junction and diagonal to Second and Christensen Street (Lido Plaza). |
| Broadway Extension | Extends from the Presidio, Lyon Street to be Marina (Lido Plaza). |
| Alameda Avenue | Connection to Broadway Extension |
| Alameda Avenue-Academy Street | Diagonal intersection Valley Street. |
| Lombard Square | Lombard extending into Van Ness Avenue (Lido Plaza). |
| Market Street-Arrillo Drive | Street diagonal to and extending Market Street (Lido Plaza). |
| Elm Grove Avenue | Intersection (Lido Plaza). |
| Ash Street and 12th Street | Terminates at Gardenia Street. |
| El Camino del Mar | Diagonal intersecting Street. Highway at Arch Street. |
| 12th Avenue | Intersection (Lido Plaza). |
| Tilton Street-Mallard Street | Diagonal intersection at Tilton Avenue |
| Geary Boulevard | Intersecting Bell to Presidio Avenue (Lido Plaza). |
| Geneva Avenue | Extending from San Jose Avenue to Ocean Avenue, Intersecting Bell Street, to Geneva Avenue, to Junipero Serra Boulevard (Lido Plaza). |

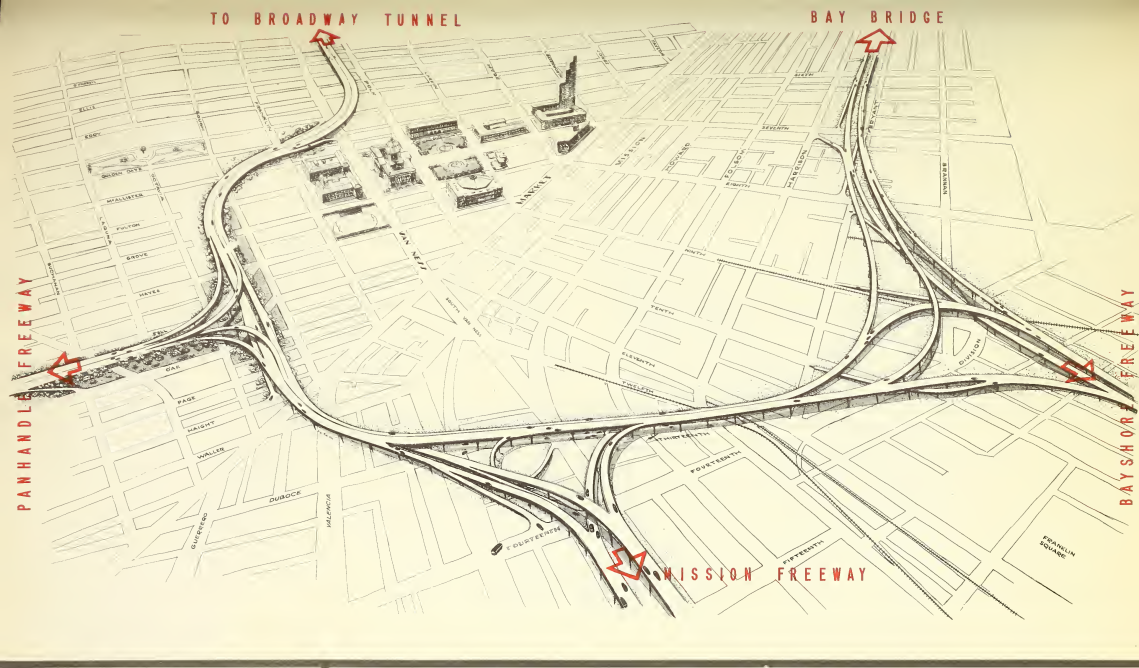
SUMMARY OF

RECOMMENDED MAJOR THOROUGHFARE IMPROVEMENTS (CONT'D)

| Major Thoroughfare | Description |
|---|---|
| Shoreline Drive | Construction through Presidio, Fort Mason and Aquatic Park (see Text). |
| 40th Avenue | Extensions through Golden Gate Park to Sunset Boulevard, and through Lincoln Park to El Camino del Mar. |
| Division Street | Extension through to Berry Street and 7th Street. |
| Laguna Street-Webster Street | Widening of Webster Street and diagonal connection to Laguna Street at Fell Street, thence to connection with Guerrero Street at Market Street. (Coincident with Western Addition redevelopment). (see Text). |
| 17th Street and Stanyan Street | Curved connection to ease turning movements. |
| Divisadero Street-Scott Street | Diagonal connection near Alta Plaza (see Text). |
| Evans Avenue | Extension over future tidelands fill to the Naval Shipyard. |
| Alemany Boulevard | Boulevard development, Mission Street to San Jose Avenue (see Text). |
| Phelan Avenue-Foerster Street | Connection through Balboa Park. |
| Holloway Avenue | Extension to Ocean Avenue at Foerster Street, and removal of traffic circles in Park Merced area. |
| McLaren Parkway | Future scenic route. |

## ARCHAEOLOGICAL AND ARCHITECTURAL DESCRIPTIVE TERMINOLOGY (CONTINUED)

| Term | Definition |
| --- | --- |
| Abacus | Square slab forming the top member of a capital. |
| Acropolis | Fortified hill or high ground in a Greek city. |
| Adobe | Sun-dried brick. |
| Agora | Open space in a Greek city used for assembly and commerce. |
| Aisle | Passage parallel to the nave, separated by columns or piers. |
| Ambulatory | Covered walk around the apse or chancel. |
| Amphitheatre | Oval or circular building with tiers of seats around an arena. |
| Amphora | Two-handled storage jar. |
| Antefix | Ornamental block at the footing of a roof tile. |
| Apse | Semicircular or polygonal recess, usually at the east end of a church. |
| Arch | Curved structure spanning an opening. |

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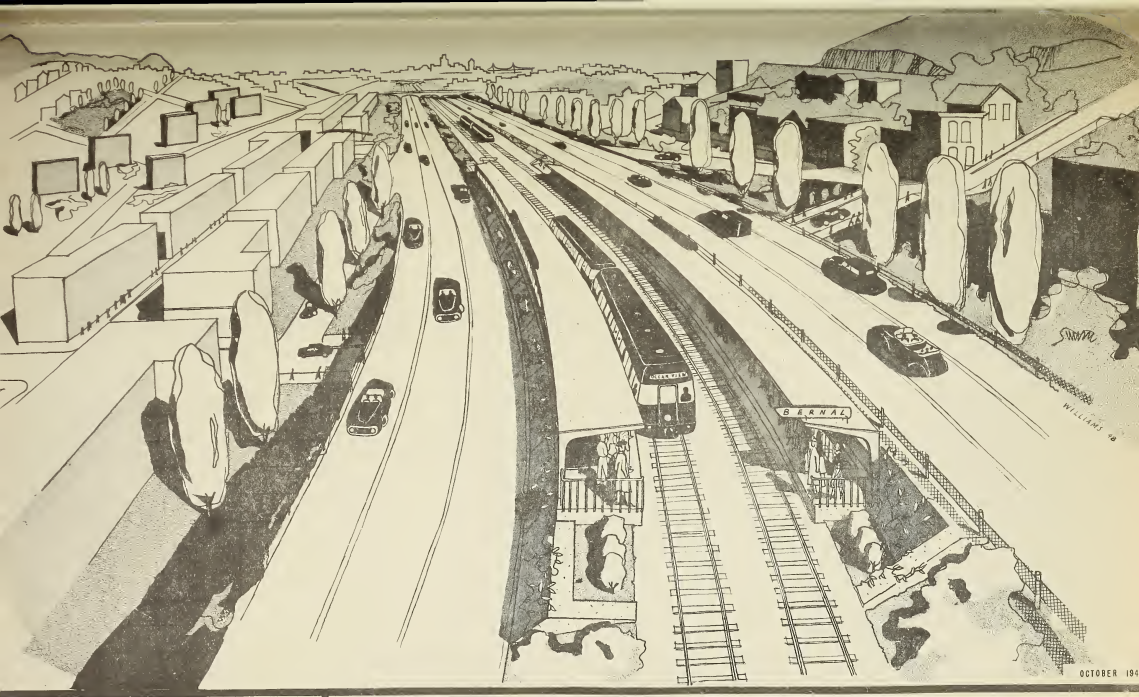
**11** TRAFFICWAYS **13** PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

# VIEW OF CENTRAL FREEWAY

## SHOWING CONNECTIONS TO PANHANDLE, MISSION, & BAYSHORE FREEWAYS AND TO BAY BRIDGE

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LADISLAS SEGOE CONSULTING CITY PLANNER

**11** TRAFFICWAYS

**14** PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

# MISSION FREEWAY

## SHOWING RAPID TRANSIT STATION AT CROSSING UNDER FREEWAY

## COST ESTIMATES

Estimates of cost of the several recommended freeways herein have been made. Land costs have been determined on the basis of present assessed valuations to which factors have been applied as recommended by city real estate experts to produce present-day market values. Construction costs have been estimated at present-day levels of labor and equipment costs, and ample allowances have been made for all overhead items including liberal allowance for contingencies. Freeway costs which have been estimated in detail, are summarized as follows:

| | |
|---|---|
| Mission Freeway | $26,960,000 |
| Panhandle Freeway | 9,480,000 |
| Sunset Freeway | 3,260,000 |
| Richmond Freeway | 3,660,000 |
| Central Freeway | 31,710,000 |
| Alemany Freeway | 14,930,000 |
| Total Cost of Freeway Program | $90,000,000 |

Not included in these estimates are the costs of the Bayshore Freeway now under construction, nor the Marginal Freeway which is considered as a part of the southern bay crossing project. Those elements of cost in the various freeways involved in the provision of either rail rapid transit or express bus facilities are excluded and are shown in the estimates of rapid transit costs in Chapter III.

The expressway and major thoroughfare improvements recommended herein and summarized in the addenda have been estimated to cost a total of approximately $21,000,000. Added to the above freeway program, the total recommended expenditures for highways in San Francisco to the year 1970 amounts to $111,000,000. This is an average of approximately $5,300,000 per annum - $1,000,000 of which will be required for expressway and major thoroughfare improvements.

This total program is generally in line with estimates of the needs of the community as established by the joint committee report in 1947 and can be financed largely through the provisions of the 1947 Burns-Collier Act.

### Stage Construction Recommended

It is suggested that a program of stage construction of freeways be determined based on the most imperative needs as shown by the estimates of use. It is contemplated that each stage would require approximately seven years for its completion, as follows:

#### First Stage

| | |
|---|---|
| Central Freeway from the Bay Shore Interchange to Post Street | $23,510,000 |
| Panhandle Freeway from the Central Freeway Interchange to Baker Street | 8,090,000 |
| Total | $31,600,000 |

Second Stage

| | |
|---|---|
| Extension of Central Freeway from Post Street to Pine Street | $ 3,140,000 |
| Mission Freeway from Central Freeway to Southwest Terminal | 26,960,000 |
| Total | $30,100,000 |

Third Stage

| | |
|---|---|
| Extension of Central Freeway to Broadway | $ 5,060,000 |
| Extension of Panhandle Freeway from Baker Street to Stanyan Street | 1,390,000 |
| Richmond Freeway | 3,660,000 |
| Sunset Freeway | 3,260,000 |
| Alemany Freeway | 14,930,000 |
| Total | $28,300,000 |

No detailed suggestions are presented for stage construction of the expressway and major thoroughfare improvements. It is recommended that the determination of these programs from year to year be made by the Department of Public Works with the approval of the Mayor and Board of Supervisors. Consideration should be given, however, to the inclusion of all or a portion of much needed and important projects during the first and second stages, as follows:

First Stage

The Army Clipper connection,

The Oak-Fell-Hayes connections,

The extension of the Broadway project west of Van Ness Avenue,

Grade separations on the Park Presidio Expressway, and

The modernization of Van Ness Avenue.

Second Stage

The Monterey Boulevard improvements,

The Market-Portola project,

Improvements to Lincoln Way and Fulton Street to provide adequate connections to the Great Highway, and

Improvements to Broadway east of Van Ness Avenue.

Certain of the remainder of expressway and major thoroughfare improvements will be added to these programs on the recommendation

Income Items

| | |
|---|---|
| Commission on Contract Purchase Items | $ 1,121,000 |
| Rent Income on Base Leases | |
| Airline Payment Loss Control Program | |
| to Government Declined | (1,000,000) |
| Total | $20,121,000 |

Other Items

| | |
|---|---|
| Reduction of Current Payment to Government | $ (1,000,000) |
| Provision | |
| Transfer to Contingent Property Items | (1,000,000) |
| Income Direct to Surplus Items | (1,000,000) |
| Personnel Expenses | (1,000,000) |
| Travel Expenses | (1,000,000) |
| Salaries Planned | (17,000,000) |
| Total | $20,121,000 |

In drafting legislation and regulations for these transactions, the Department and Major Procurement Improvements. It is recommended that the determination of which procurements these rules be given to each of the Departments of Service should also rest with the Secretary of Defense, Consideration should be given, however, to the inclusion of [illegible] and should provide, as follows:

Effect Clause

The Act shall [illegible] commencing,

[illegible] of the Secretary of the Treasury [illegible] of [illegible] Taxes thereon,

The repeals of the following [illegible] Act, [illegible] Act,

[illegible] Act,

[illegible] Act,

Savings Clause

The foregoing provisions [illegible]

The Secretary [illegible]

[illegible] to [illegible] [illegible] Act [illegible] Act,

[illegible] Act, and

[illegible] Act, if any [illegible]

Transfer of the functions of [illegible] and [illegible] [illegible] [illegible] to [illegible] with [illegible]

of the Departments of Public Works and City Planning to meet urgent needs as they may develop from year to year with changing traffic patterns.

## ECONOMIC JUSTIFICATION OF FREEWAY PROGRAM

The construction of any new highway facility for the use of the public, such as the proposed system of freeways for San Francisco, must be justified by benefits weighed against costs. Such a study has been made on the basis of assumptions comparable to those which have proven sound under the rigid financing requirements for revenue producing facilities. These studies indicate that the proposed freeway system would be a good investment for the motorists and other taxpayers of San Francisco and that for this reason, as well as for all of the social benefits anticipated, the projects should be approved and built.

Studies were made by the consultants of average speeds of vehicle operation in various parts of the city under present conditions. These speeds vary from an average of 10 miles per hour in portions of the Metropolitan Traffic District, to 30 miles per hour on outlying highways. It is estimated that weighted average speeds for all motor vehicle travel are between 20 m.p.h. and 25 m.p.h. Average speeds of 35 to 40 m.p.h. would prevail on the proposed freeways. Time savings, therefore, would be approximately one minute per mile.

The value of a motorist's time has been debated for a number of years without arriving at a generally accepted figure. Actually, the amount a motorist or a truck operator is willing to pay for the use of a superior facility depends not alone on potential time savings but also on the extent to which relief is afforded from accident hazards, possibilities of major delays caused by pedestrians, traffic signals, turning vehicles, and all of the other vexations typical of surface streets. The success of the Golden Gate and Bay Bridges as replacements of the slower and less convenient ferries indicates spectacularly the value the traveling public places both on time savings and on convenience.

A report entitled "Toll Roads and Free Roads" published by the Bureau of Public Roads in 1939 estimated that a toll of approximately one cent per mile for automobiles and 3.5 cents per mile for trucks, which would produce a weighted average toll of 1.5 cents per vehicle-mile, would develop maximum revenues on a toll road. Inflationary trends since 1939 would make a comparable figure for 1948 at least 2 cents per vehicle-mile. At freeway speeds, this would be equivalent to about 1.25 cents per vehicle-minute of travel on a freeway.

Actual savings in out-of-pocket costs on freeways have been measured directly. According to recent studies by the Automobile Club of Southern California, fuel consumption on the Arroyo-Seco Parkway in Los Angeles was found to average 20.75 miles of operation per gallon of gasoline, while driving on adjacent downtown streets produced only 8.70 miles per gallon. On the average city street in Los Angeles only 16.51 miles per gallon was obtained. The Oregon State Highway Department has found that each stop made from a speed of 35 m.p.h. costs a motorist approximately two mills. There are no stops on freeways. The saving in accident costs is also striking.

# CHAPTER III

## THE LOCAL TRANSIT PLAN

On March 5, 1948 we completed an interim report on a plan for modernization of the municipal transit system and related matters, including improved functional traffic control along downtown Market Street, and for certain modifications in the one-way street pattern in the Metropolitan Traffic District.

While our assignment covered primarily the development of long-range plans for all phases of transportation in the City of San Francisco, it was necessary to determine initially the pattern and character of public transit modernization in order to provide a base on which to project plans for ultimate long-range developments.

We found that San Francisco now has an exceptional opportunity to obtain a dramatic improvement in public transit. Through the elimination of the competing privately owned transit lines, costly, weak, and inefficient duplicating services can be consolidated into an efficient, integrated system which will provide more frequent service at greater speeds in comfortable cars and buses. Uncomfortable crowding can be eliminated, service standards can be improved and at the same time operating expenses can be actually decreased.

This may be accomplished during the next four or five years through the judicious expenditure of bond issue funds now available, plus equipment depreciation reserves to become available. Except for a limited number of cars and buses purchased during the last five years, all present rolling stock is obsolete or will be due for retirement during the rehabilitation period. Many years of competition by two separate transit organizations have left San Francisco with an illogical pattern of local transit routes. In the older and more densely populated northerly and easterly sections, duplicate services are frequently operated on adjacent parallel streets. This results in weak and infrequent service and also interferes with the efficient use of numerous thoroughfares by private free-wheel traffic.

The availability of flexible trolley bus or gas bus equipment will relieve the system of a track tied operation, many routes in which were determined in the last century. Free-wheel equipment will also permit an expansion of express services to most of the outlying sections, similar to the express bus routes now operated on Noriega and Third Streets. Trolley buses or gas buses are recommended for all local routes except two operating through the Twin Peaks tunnel.

One of the principal objectives sought in the development of a new pattern for transit operations in San Francisco was spacing of parallel routes so as to provide the best possible overall travel time between the point of origin and the point of destination. There is an advantage in concentrating traffic on individual routes to the point where service can be provided on frequent headways, providing, of course, that such concentration does not result in unreasonable walking distances.

Running time will be improved through the purchase and operation of new high-speed vehicles. In addition, express service should be operated wherever traffic volumes warrant and such service has been planned. It is also considered highly important that service standards

be improved materially over those now in effect. For that reason, new operations have been planned to provide an average of seats-for-all, except during the rush hours when standees will be limited to 50 per cent of the number of seated passengers.

The March report recommended a pattern of transit routes at the completion of the modernization program which serves virtually all developed sections, most of which are within one-quarter of a mile of transit routes. The only sections beyond a quarter-mile from a transit route are hilltop areas with sparse population or areas as yet undeveloped. New route numbers are suggested as an aid to the traveling public.

Analyses of comparative economies of alternate sizes and types of equipment were made in detail as a preliminary to determining our recommendations. Frequency of service was also considered.

Estimates of operating expenses were based on the average of such expenses, as reported by the auditor of the Municipal Railway for the six months period from July through December, 1947. These expenses, including allowances for accident reserves, are as follows:

| | | |
|---|---|---|
| Street Cars | - | $7.11 per car hour |
| Cable Cars | - | $7.65 per car hour |
| Motor Bus | - | $4.50 per bus hour |
| Trolley Bus | - | $3.86 per bus hour |

The large number of routes proposed for trolley bus operation is noteworthy. These vehicles have proven satisfactory in San Francisco and are admirably suited to local hilly topography. As an indication of their economic advantage, our analysis of Route (16) - Mission Local- may be cited. The annual costs of the two types of equipment are as follows:

| Equipment | Operating Expenses | Interest and Depreciation | Total |
|---|---|---|---|
| Street Cars | $1,040,000 | $227,000 | $1,267,000 |
| Trolley Buses | 735,000 | 123,000 | 858,000 |

Subsequent to the completion of the March report, we reviewed all available origin and destination data, cordon and other traffic counts, population forecasts, previous proposals for transit modernization, land use studies, proposals for major street improvements and freeway plans. We have inspected the various locations suggested for transit routes and freeways and have become acquainted with the topographical features of different parts of the city. Innumerable studies have been made during the past year of alternate practicable means of providing adequate local and rapid transit for San Francisco and there are presented here our recommendations as to the most appropriate pattern for that system to take.

San Francisco is a compact city and perhaps for this reason has not felt the necessity for rapid transit facilities comparable to those experienced in other cities of its importance. Suburban service has been furnished by the Southern Pacific Company along the eastern shore of the Peninsula, by the Key System across the Bay Bridge, and by Pacific Greyhound Lines and other bus companies to all parts of the metropolitan area. Local residents, however, have depended for public transportation on local street car and bus lines. It is estimated that transit riding will increase in direct proportion to population increases plus 10 per cent on local lines and 20 per cent on rapid transit lines - induced traffic resulting from improved service.

Rapid Transit - A Necessity

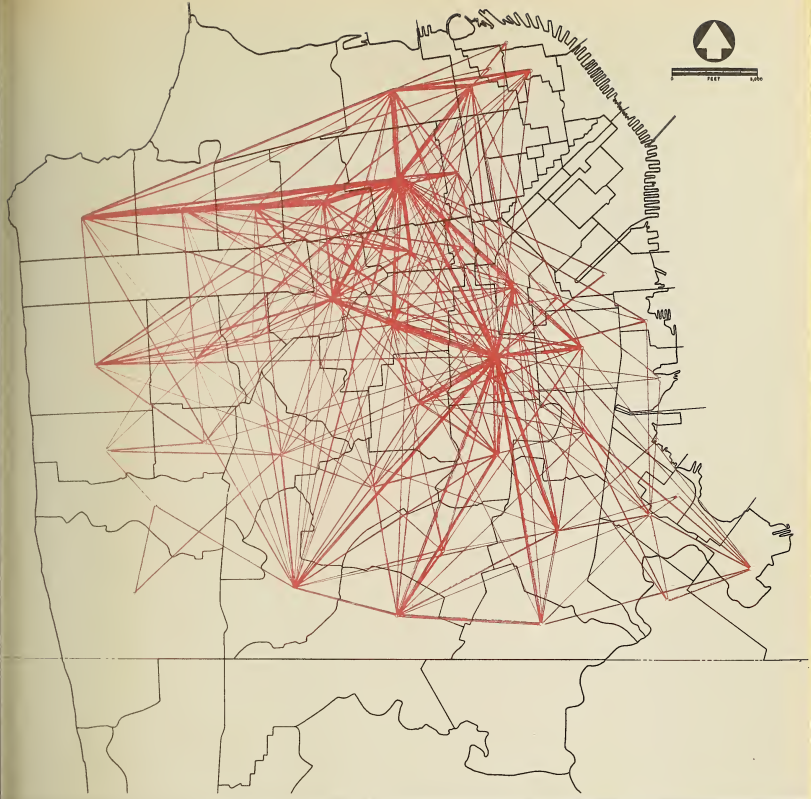
Our approach to the problem was an attempt to provide the necessary and vital improvements to public transit through modern high speed equipment operated over the local street system improved by applying all known and proven traffic engineering techniques. The hope was that the relatively short haul between home and work in San Francisco could be accomplished in reasonably short travel time without any heavy capital outlay for subways or other expensive grade-separated facilities. Thorough appraisal of prospective future developments proved, however, that certain grade-separated structures were required to provide for San Francisco's needs, especially in the downtown terminal area.

The primary destinations of transit passengers in San Francisco presents a pattern unique among large cities. The principal area to be served is stretched out along and somewhat to the north of Market Street over a distance of almost two miles. This area includes the Civic Center, the theatre and hotel district, the shopping district, the financial district and the waterfront area including the Ferry Building.

Market Street is now loaded almost to its capacity with transit vehicles. Any substantial increase in transit traffic will result in slower speeds and less satisfactory service. We estimate that by 1970, the numbers of transit vehicles on Market Street which would be required to serve the prospective passenger load would result in intolerably low speeds even with the wider spacing of stops and vastly improved traffic control and signal system which has been recommended.

Increased numbers of buses required to serve the rapidly growing outer sections of the city, as well as the suburban district would, in the absence of off-street terminals, clutter up the downtown street system to the point of stagnation.

The metropolitan area is growing rapidly in population and promises to continue to grow steadily. Most of the new residential areas will be at considerable distances from the central business district, and much of the residential growth will be beyond the city limits both on the Peninsula and across the Bay. The most suitable residential areas inside the city limits are almost completely developed, and some of the closer-in areas will lose population as more space is demanded by industrial and commercial developments and and public facilities. Furthermore, the popular trend for some time, stimulated by the increasing ownership of automobiles, is toward the



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LOCAL TRANSIT

III

# DESIRE LINES OF TRANSIT PASSENGERS

## TRAVELING BETWEEN SEGMENTS OUTSIDE THE METROPOLITAN TRAFFIC DISTRICT 1947

1 LINE = 100 PASSENGERS

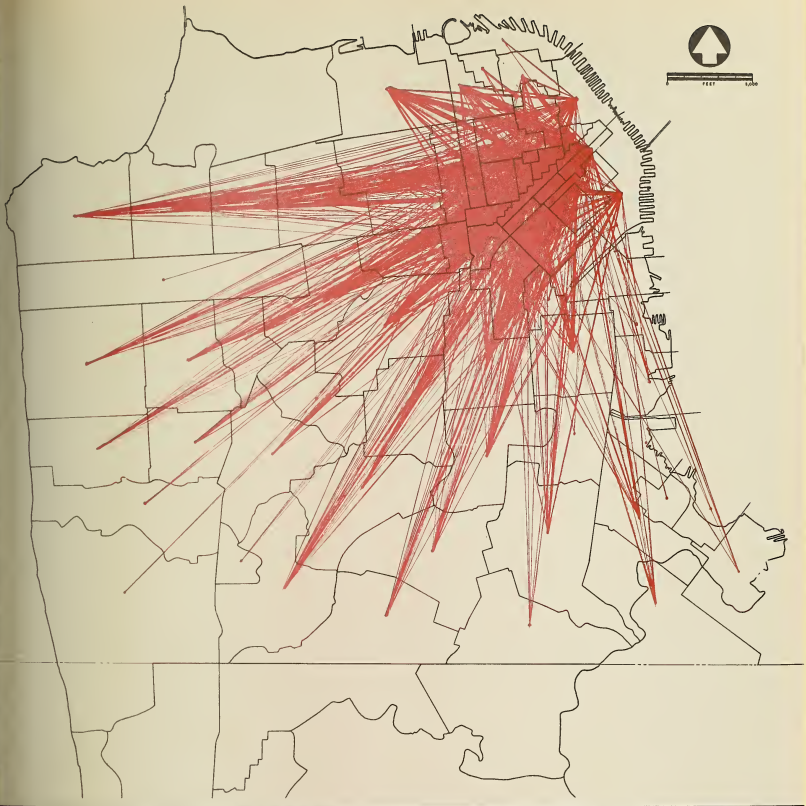
$\frac{1}{16}$" BAND = 3200 PASSENGERS

SOURCE B.A.M.T.S. 1946-47, CALIFORNIA DIVISION OF HIGHWAYS

1

PLATE

AN FRANCISCO DEPARTMENT OF CITY PLANNING



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# DESIRE LINES OF TRANSIT PASSENGERS

## TRAVELING BETWEEN THE METROPOLITAN TRAFFIC DISTRICT AND OUTSIDE SEGMENTS – 1947

1 LINE = 100 PASSENGERS

1/16" BAND = 3200 PASSENGERS

SOURCE: BANTS 1946-47, CALIFORNIA DIVISION OF HIGHWAYS

LOCAL TRANSIT

III

2

PLATE

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LOCAL TRANSIT

# DESIRE LINES OF TRANSIT PASSENGERS

## TRAVELING WITHIN THE METROPOLITAN TRAFFIC DISTRICT

## 1947

1 LINE = 100 PASSENGERS

$\frac{1}{16}$" BAND = 3200 PASSENGERS

SOURCE: B.A.M.T.S. 1946-47, CALIFORNIA DIVISION OF HIGHWAYS

III

3

PLATE

widespread, thinly populated, suburban areas surrounding our larger cities.

Another compelling argument for rapid transit is that the best solution of the traffic problems currently plaguing the city is to attract more people to public transportation. The streets in the Metropolitan Traffic District are reaching a point of near saturation. Parking facilities are inadequate and costly to provide. Even the freeways, proposed as a solution to one phase of the traffic problem, will be seriously overloaded eventually unless attractive transit service is provided concurrently with their construction.

Another reason rapid transit is necessary is that economical and efficient operation of the Municipal Railway requires that long-haul passengers be moved at high speed. A transit vehicle moving at 30 m.p.h. can furnish twice as many seat-miles in a given time as the same vehicle moving at 15 m.p.h. Rapid transit also tends to concentrate transit patrons, so that they can be moved efficiently in large vehicles.

We conclude that rapid transit will be required to meet San Francisco's needs and present herewith a plan that is practicable from a financial, operating, engineering and civic viewpoint.

## THE RAPID TRANSIT PLAN

This plan has been developed taking a long-range view of the problem and is intended to be developed in stages. There are a number of questions of policy involved, however, in connection with the proposed freeway system and with the selection of types of vehicles for the current transit modernization program which should be influenced by considerations of the ultimate rapid transit plan. We recommend the adoption of a basic rapid transit plan shown on Plate III-4 with the thought that the rapid transit routes should be constructed gradually in coordination with the rest of the improved highway, transit, traffic and parking program for San Francisco.

### Feasible Types of Rapid Transit

The existing Twin Peaks tunnel, and certain of the proposed freeways, provide rights-of-way on which high speed service can be operated. The Bayshore Freeway entering San Francisco from the south is now under construction and the California Department of Public Works has definite plans for extending it to a connection with the Bay Bridge. Additional limited access highways of this type serving other parts of the metropolitan urban area are recommended in Chapter II of this report and undoubtedly will be undertaken within the next few years.

The high cost of highways of this character makes their intensive use imperative. The number of people served by such a facility can be more than doubled by the operation of a comparatively small number of express buses on the freeways. When the potential patronage of public transportation is such that the number of buses required to accommodate them would seriously interfere with the flow of other traffic on a freeway, it becomes advisable to provide a separate right-of-way as a part of the design for this high type transportation artery to permit the installation of rail rapid transit facilities.

Many factors influence decisions as to the best type of transit equipment to use on a particular route. For example, the fact that track and electrical overhead is already available in the Twin Peaks tunnel would at least suggest the use of rail rapid transit on this route.

When considering rapid transit on a proposed freeway, it is well to make a study of the future volumes of all types of traffic likely to use that route. It is then possible to determine whether or not the number of buses required could be absorbed in the traffic stream without over-loading the highway and causing congestion and delay for all classes of users.

The probable volume of transit patrons to be served on each projected route has been carefully estimated in order to select the type of vehicle which could be operated most economically for that intensity of traffic. The type of vehicle must also be considered in connection with problems of routing, provision of feeder routes, probability of future extensions and terminal facilities.

Finally, the selection of type of equipment is influenced by the problem of handling that equipment in the Metropolitan Traffic District. All of the time saved in moving rapidly from the outlying areas to the edge of the downtown district could be lost in two or three blocks along a badly congested street. The problem of moving the large volume of transit vehicles at reasonable speeds points to the need for a special right-of-way for this purpose in the area of greatest congestion.

Market Street Subway

All previous engineering reports have included a subway on Market Street as the key to a sound transit plan. We concur in the findings of these previous studies and recommend a two-track subway in Market Street extending from a downtown terminal loop near the Bay Bridge Terminal along Market Street, through the Twin Peaks tunnel, along West Portal Avenue and private right-of-way to a terminal station in the Lake Merced district now being developed a short distance west of 19th Avenue. The downtown section of the subway, east of Van Ness Avenue also would serve as a terminal for trains from the Mission route, as described later.

A rapid transit route along Market Street would be in close proximity to the centers of areas of primary destinations. It would also be close to the Bay Bridge terminal which should be served in order to provide a distribution facility for the commuting traffic from Oakland and beyond. Most of the local transit routes also operate into, along, or across Market Street so that transfer connections would be provided between them and any major trunk line along such a route.

It is recommended that the subway be built in stages. The first stage would terminate at a portal in the center of the roadway located to the west of Van Ness Avenue. The route would extend along Market Street from the portal to First Street, then loop to Mission with a station at the Bay Bridge terminal, continuing to Beale, to Pine, to Sansome and to Market with stations on Pine and on Sansome Streets. It is recommended that this subway be built as near the surface of the street as practical and without mezzanine stations or passageways. The stations would be 300 feet long and would be along the sides of the subway rather than in the center. They should be spaced approximately 1,000 feet apart along Market Street to permit average speeds of about

16 m.p.h. in place of the present rush hour speeds on Market Street of about 5 m.p.h. The stations could connect directly with basement levels of nearby stores and buildings, as well as with the sidewalks.

This initial subway section in Market Street would have a total length of approximately 7,700 feet of two-way section and 4,600 feet for one-way operation. The estimated cost is $26,500,000.

Prior to the completion of the downtown Market Street subway, it would be necessary to complete the southwesterly terminal in the Lake Merced area. This would include terminal and service facilities, a transfer station to provide for convenient transfer of passengers from feeder buses to trains; a low level track connection under 19th Avenue; and a portal in private right-of-way with tracks coming to grade near the St. Francis Circle. This development is considered a part of the current modernization program and, therefore, is not included in our cost estimates.

Operation would start at the proposed southwesterly terminal thence over the present tracks in West Portal Avenue and through the Twin Peaks tunnel, operate over the surface of Market Street (in the initial stage) from the present East Portal to a proposed portal near Van Ness Avenue and there enter the proposed Market Street terminal subway. P.C.C. type rail equipment, operated initially in two-car trains in rush hours, is recommended for this route. It is estimated that by 1970 there will be 34,000 passengers in one direction through the heaviest load point during a 24-hour normal weekday of which some 8,100 will travel in the heaviest hour.

This route would be supported by feeder lines converging from all directions on the proposed new outer terminal, by passengers living within walking distance of the various stops along the route, and by passengers who would transfer from the several crosstown transit lines intersected.

Bayshore Express Bus Route

The Bayshore Freeway has now been completed through a portion of San Mateo County and is under construction in South San Francisco. Contract drawings for the sections within the city limits are well advanced. This design provides for eight lanes in the city portion of the route.

Our studies confirm that there is no need for rail rapid transit on the Bayshore Freeway and that buses can efficiently handle the probable volumes of transit passengers. It is estimated that the 1970 traffic will be some 18,000 passengers in one direction through the heaviest load point on a normal 24-hour weekday, of which 3,600 will move in the heaviest hour. This traffic could be carried by approximately 52 large buses in that one-hour period.

Vehicular traffic on the Bayshore Freeway will be heavy, amounting to 51,000 vehicles in both directions in 24 hours on a normal weekday assuming the proposed Mission Freeway is also built. In arriving at an estimate of this volume, which is within the capacity of the freeway, it was also assumed that the attractive express bus service would be operated on the highway.

As contemplated the essential characteristic of this service will be that buses will operate over local streets near the south city limits entering the Bayshore Freeway near Third Street. These buses will make service stops for local passengers and those transferring from crosstown bus lines at or near Silver Avenue, Alemany Boulevard, 24th Street and 16th Street. Buses serving the airport and various suburban centers in San Mateo should also be routed over this freeway. Stops can be made either by means of ramps to and from the local street system provided for the use of general traffic, or by specially designed bus stations incorporated in the freeway structure. Plans as presently developed would permit these bus stops by means of ramps at one or two locations. It is recommended that negotiations be undertaken with the State Division of Highways to the end that suitable provision be made for the express bus stops recommended.

Distribution of the Bayshore Freeway express bus passengers will be accomplished under the proposed plan by operation along 7th and 8th Streets and along Mission Street to the proposed off-street bus terminal on the east side of Second Street - to be described later. This would provide a convenient direct connection to the Bay Bridge terminal and to the Post Street subway.

Mission Freeway Route

Rapid transit operation along the Mission Freeway would attract sufficient volumes of traffic to justify the operation of two-car or three-car trains in the rush hours by the year 1970. It has been estimated that these volumes would be about 44,000 passengers in one direction through the heaviest load point on a 24-hour normal weekday by 1970, with 8,800 passengers in one direction in the heaviest hour.

It is also estimated that a six-lane expressway in this location will be loaded with some 65,000 vehicles daily by 1970 so it is appropriate that a separate right-of-way be provided in the design of this facility for the exclusive use of transit vehicles. If buses were to be operated on this route, it would be necessary to provide eight lanes for moving traffic rather than six. Since the rapid transit right-of-way would occupy in part the space otherwise provided for a center dividing strip in the highway, the expressway with a two-track rapid transit facility will require little or no additional right-of-way over that which would be needed if all public and private transportation were to be accommodated on the highway pavements alone.

The use of electric rail vehicles on the Mission route will permit their being routed directly into the Market Street subway. This is planned by operation through a short subway extending from a connection at the center of the depressed highway at 15th Street and thence along South Van Ness Avenue to a connection with the Market Street subway just east of Van Ness Avenue.

The additional facilities which will be required for rapid transit rail operation are indicated on the plans and profiles of the Mission Freeway, Plates II-3-3, 4, and 5, and the connection to the Market Street subway is shown on Plate III-10the plan and profile of the downtown section of the Market Street subway. Plate II-14 shows a delineation of the proposed Mission freeway - rapid transit project, and indicates the general features of the intermediate rapid transit stations proposed.

A division terminal is proposed just south of San Jose Avenue as shown on Plate II-S-3. Trains would operate from a stub terminal at depressed grade and feeder buses serving adjacent areas in San Francisco, in Daly City and suburban centers to the south would be routed to a platform at street level to provide for convenient interchange of passengers from feeder buses to waiting subway trains. It is recommended that the railroad right-of-way to San Mateo be held by the City of San Francisco, with a view to extension of rail service to San Mateo and intermediate points if traffic generated in these areas should warrant such future investment.

A portion of the area between Sagamore Street and Alemany Boulevard would be utilized for the division terminal with tracks at the depressed level. Some of the remaining area could well be devoted to parking facilities for the use of those who desire to leave their automobiles and complete their journey to the downtown district or intermediate points by convenient rapid transit trains. Part or all of the rail terminal may be decked over for this purpose as future developments may warrant.

Rapid transit stations along the freeway portion of the route are recommended at or near Ocean Avenue, Bosworth Street, Cortland Avenue, Army Street, 20th Street and 16th Street. A transfer station is planned on the Market Street subway just east of Van Ness Avenue to provide for convenient transfer between the two rapid transit lines. Mission route trains would be operated to the downtown terminal loop through the Market Street subway above described.

Post Street Subway

The completion of the Panhandle, the Richmond and the Sunset Freeways, and also the Geary Street Expressway, will provide admirable facilities for the operation of express buses serving the Richmond and the Sunset Residential areas as will be discussed subsequently. Estimates of the number of passengers who would be attracted to such special services indicate that the number of buses required during the rush hours will reach substantial totals. It is our opinion that the number of trolley buses and buses operating on local routes into and through the Metropolitan Traffic District will absorb all of the capacity of the downtown streets which should properly be utilized for public transit service. It follows that off-street terminal facilities for the express buses routed over the Panhandle Freeway and the Geary Expressway should be provided in our long range plans.

A somewhat detailed study has been made, therefore, of terminal routings of express buses which would avoid imposing an undue load on the downtown streets. Consideration has been given to the origins and destinations of passengers from the Richmond and Sunset districts in determining the character and location of suitable off-street facilities. The studies have also considered other highway and transit facilities planned for the central terminal area.

It has been found that all objectives can best be served by the construction of a subway along Post Street, from a special connection to the Central Freeway extending thence east along Post Street to Market Street; thence along Second Street to an off-street terminal located between Minna and Natoma Streets between the easterly side of Second Street and the westerly side of the Bay Bridge Terminal.

The proposed ramps for special use of buses from the Central Freeway and from the Geary Expressway are shown on Plate II-S-2. A preliminary plan and profile of the Post Street subway is reproduced on Plate III-7. A preliminary study of the proposed off-street bus terminal on 2nd Street is reproduced on Plate III-13.

The topography along Post Street is such as to favor the construction of this subway by tunneling methods. A circular section is recommended, as shown on Plate III-8. Such a section would accommodate either trolley buses or gasoline buses - ample space being available for generous ventilating facilities required in the event of gas bus operation. Station platforms would be served by mezzanine stations located as close as possible to the street surface. The cost estimates include allowance for the liberal installation of escalators between the low level platforms and the mezzanines.

Five stations with platforms 200 feet in length are proposed between Leavenworth and Hyde Streets; at Mason Street; between Stockton Street and Grant Avenue; at Montgomery and Market Streets; and at the proposed Second Street terminal south of Mission Street. Facilities for the interchange of passengers between the Post Street and the Market Street subways would be provided at Market Street where the Post Street subway would pass directly under the Market Street structure. In addition to a direct connection to the Second Street terminal, it is recommended that a ramp be located in the center of Second Street just south of Mission Street.

Provision of connections to both the Central Freeway and Geary Street assure the full use of the Post Street subway to its capacity from the first day of operation. The number of express trolley buses or buses required for the operation of these three routes during the rush hours will exceed its efficient capacity so that in any event there will be a limited number of vehicles from these three express routes which will operate over the downtown streets. It is proposed that this subway, which is in reality an underground street, be brilliantly lighted and that it be operated without signals except at and near the portals.

It is suggested that approximately half of the trolley buses or gas buses operated through the Post Street subway be routed to the Second Street terminal and that the remainder be operated along Second Street to Brannan Street and along Brannan Street to the proposed off-street bus terminal opposite the Southern Pacific Station at Third and Townsend Streets, as will be discussed subsequently.

It may be noted that this recommendation conforms functionally with previous proposals for subways in Geary Street and other thoroughfares to the west towards the Richmond District. The chief advantage of the present project is its flexibility which assures its full and efficient use through the concentration of vehicles from three separate bus routes.

Sunset Express Bus Route

To provide additional rapid transit service for the Sunset District, an express bus service is recommended. This route would extend from a terminal at the west end of Noriega Street; along Noriega Street to 19th Avenue; and along 19th Avenue to the Sunset Freeway;

making local stops through this entire pickup area.

Station stops on the freeway are proposed at 9th Avenue; in Golden Gate Park at a location opposite Kezar Stadium; at Masonic Avenue; at Divisadero Street; at Fillmore Street; and at Van Ness Avenue as shown on the freeway plans - Plates II-S-7 and 8. This will provide convenient facilities for transfer of passengers from crosstown transit routes to fast downtown express bus service. It is suggested that a special bus terminal loop be provided just west of Kezar Stadium with capacity sufficient to handle the large number of buses required to serve the extraordinary concentration of crowds leaving Kezar Stadium.

Richmond Express Bus Route

A similar express bus service is recommended to serve the Richmond District. This route would extend from the present terminal at La Playa and Cabrillo, thence along Cabrillo to 45th, and along Balboa Street to Park Presidio; and thence along this expressway to a connection with the Richmond Freeway at Fulton Street.

Express buses would make local stops through this entire feeder area. They would operate at high speeds along the Richmond Freeway, the Panhandle Freeway and the Post Street subway to downtown terminals. Station stops are proposed at 8th Avenue; at Masonic Avenue; at Divisadero Street; at Fillmore Street; at Van Ness Avenue; and at the five stations in the Post Street subway.

Geary Express Bus Route

The ultimate improvement of Geary Street as an expressway, as a part of the redevelopment plan for the area to the west of Van Ness Avenue, has been recommended. When completed, this will provide an excellent route for the operation of limited stop bus service extending west to the center of the populous Richmond District. The plans for current modernization provide for the operation of a measure of express bus service along this route over the existing street system. This will afford a definite improvement and convenience at this time.

When Geary Street is ultimately converted into an expressway, and when the Post Street subway is completed, a further substantial improvement will result from the operation of a strong express bus service along Geary Street to special portals into the Post Street subway. The express buses from this route, together with those from the Richmond and Sunset Freeways, will provide extremely convenient and frequent service in the Post Street subway affording delivery to the heart of the shopping district, to the financial district, to the Bay Bridge Terminal and to the Southern Pacific terminal at Third and Townsend Streets.

Effects on Interim Developments

The gradual development of the rapid transit facilities recommended will require a few slight modifications in the first stage modernization program recommended in our report of March 5. That program contemplated the conversion of all local services in the city to rubber-tired operation, with the exception of the two routes to be operated through the Twin Peaks tunnel. The modern street car equipment

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OCTOBER 1948

# PROPOSED TRANSIT PLAN

- RAIL SUBWAY ROUTES
- FUTURE EXTENSION
- BUS SUBWAY AND FREEWAYS
- SURFACE EXTENSIONS OF BUS ROUTES
- RECOMMENDED 1948 TRANSIT ROUTES

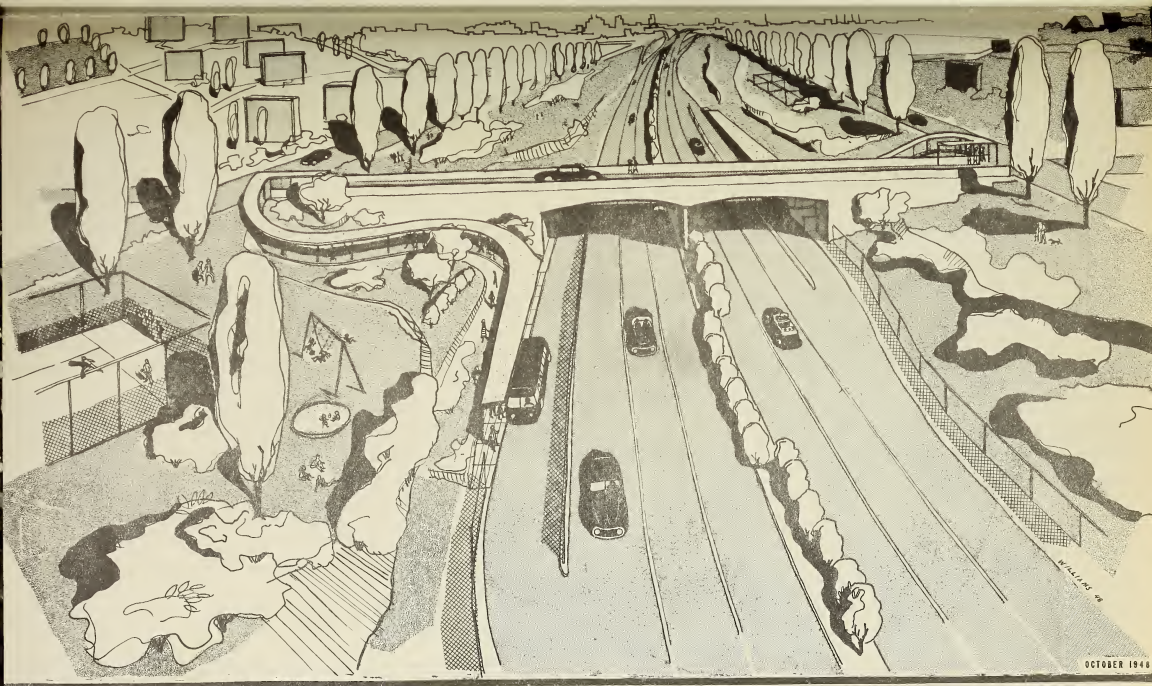
TRANSIT

III

4

PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

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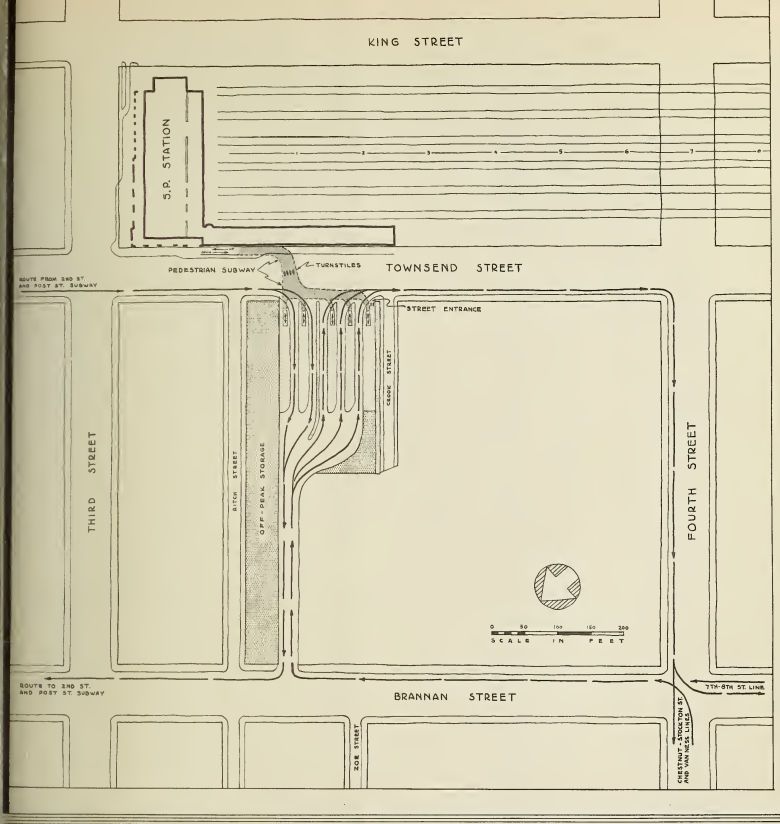
**III** TRANSIT **5** PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

# PANHANDLE FREEWAY

## SHOWING BUS STATION AT OVERHEAD CROSSING

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# BUS TERMINAL — THIRD & TOWNSEND STREETS

BUS ROUTES

PEDESTRIAN SUBWAY

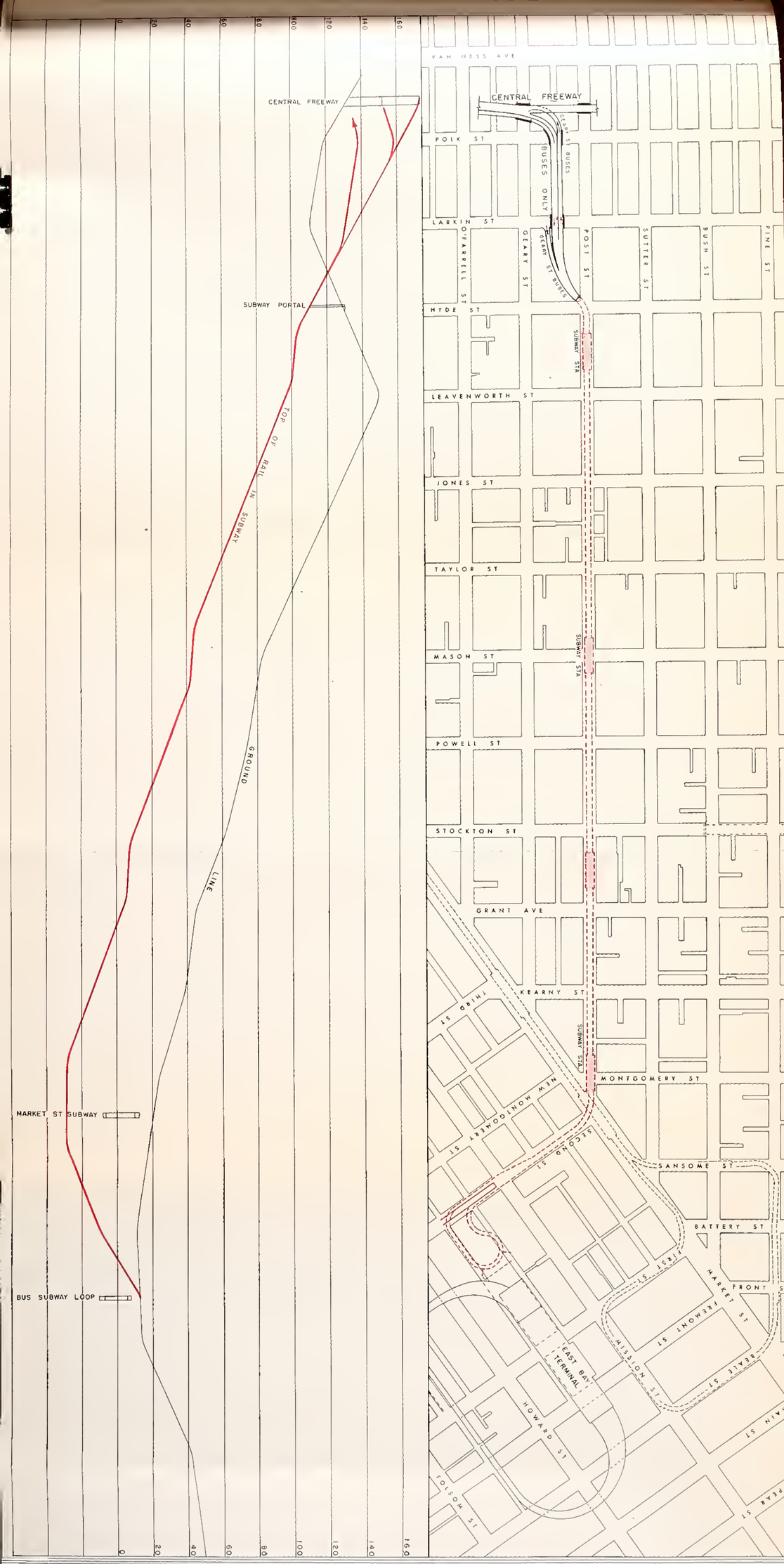
LOADING PLATFORMS

BUS STORAGE

TRANSIT III

6 PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING




LOCAL TRANSIT

III

7

PLATE

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# POST STREET SUBWAY

HYDE STREET (CONNECTION TO CENTRAL FREEWAY) TO SECOND STREET TERMINAL

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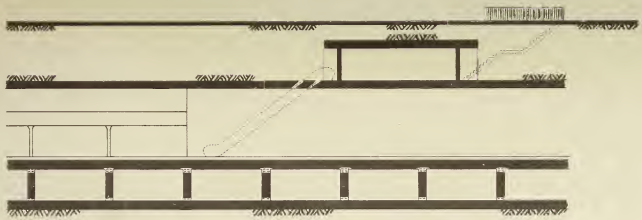
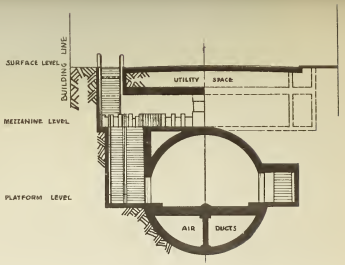
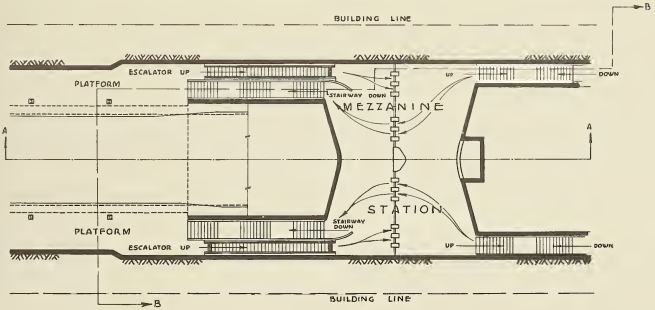


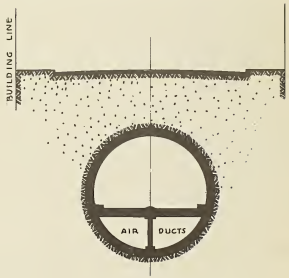
LONGITUDINAL SECTION A-A




TRANSVERSE SECTION B-B




PLAN C-C



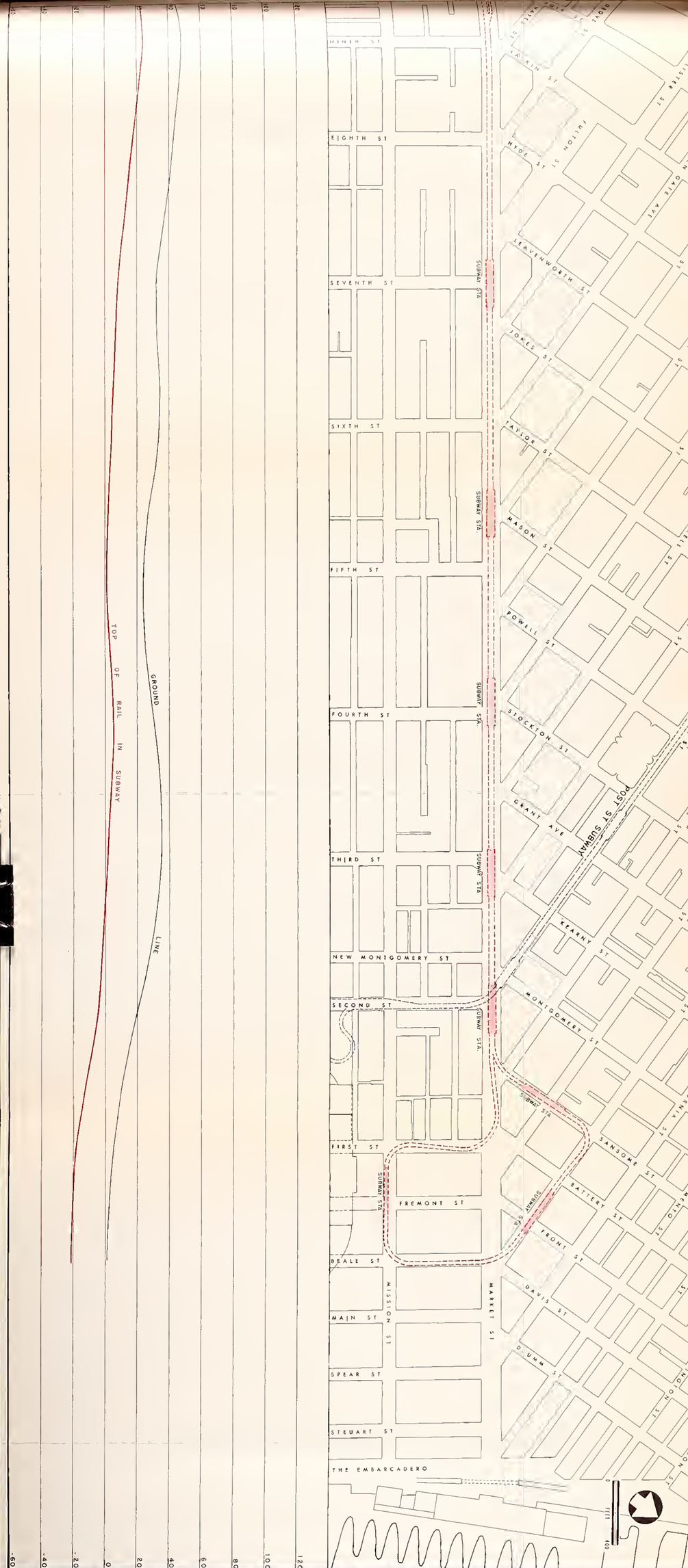

TYPICAL SECTION

III TRANSIT 8 PLATE

# POST STREET SUBWAY

SHOWING TYPICAL SECTIONS & STATION PLAN

0 10 FEET 30 40




LOCAL TRANSIT

III

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PLATE

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# MARKET STREET SUBWAY

THE EMBARCADERO TO NINTH STREET

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LOC L TRANSIT

III

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PLATE

# MARKET STREET SUBWAY

## NINTH STREET TO TWIN PEAKS TUNNEL (EAST PORTAL)

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LOCAL TRANSIT

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PLATE

# MARKET STREET SUBWAY

## TWIN PEAKS TUNNEL (WEST PORTAL) TO NINETEENTH AVENUE AT EUCALYPTUS DRIVE

OCTOBER 1948

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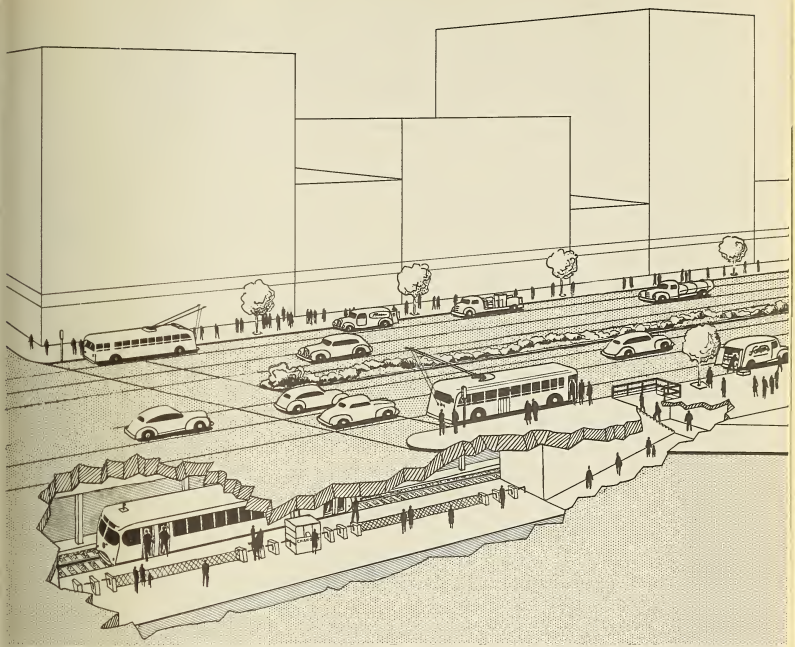
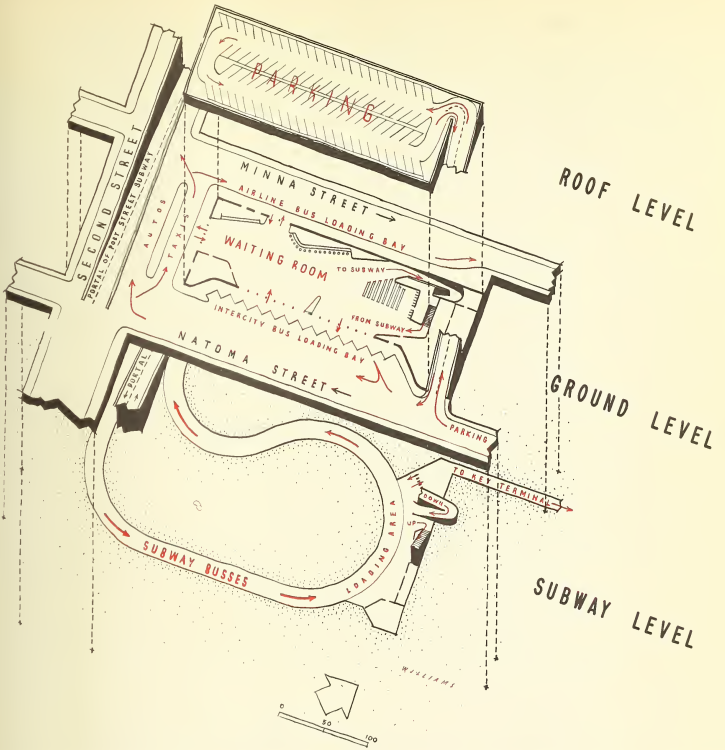


| 111 TRANSIT | 12 PLATE |
|---|---|

# MARKET STREET SUBWAY

SHOWING TYPICAL SECTION AT STATION

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LOCAL TRANSIT

III

# SECOND STREET TERMINAL OF POST STREET SUBWAY

SHOWING PROVISIONS FOR INTERCITY BUSSES, AIRLINE BUSSES, AUTO PARKING, AND CONNECTION TO KEY SYSTEM TERMINAL.

13

PLATE

## The Rapid Transit Pattern

Estimates have been projected to determine the probable operating characteristics of the several express bus and rail rapid transit lines recommended. This entire system will come into being by stages and there is no way of predicting at this time just what year service might be inaugurated on any one of the six rapid transit lines. For that reason the estimates are all based on conditions forecast for the year 1970. These rapid transit operations at that date would provide for daily travel of passengers toward the central business district as follows:

| | |
|---|---|
| Bayshore Express Bus | 18,000 |
| Mission Rapid Transit | 44,000 |
| Market Street-Twin Peaks Rapid Transit | 34,000 |
| Geary Express Bus | 14,000 |
| Richmond Express Bus | 13,000 |
| Sunset Express Bus | 13,000 |
| | 136,000 |

Most of these passengers would be delivered to the central area in the Market Street subway and in the Post Street subway. Thirty-two thousand passengers daily would originate in suburban areas south of the city and all passengers, excepting those utilizing the Southern Pacific Railway service, are included in the estimates. When the subway program is finally completed, approximately one-half of all of the public transit passengers will be delivered to the central business district by subways. In addition, passengers who are delivered to the central area by the Bayshore express buses would be provided with off-street terminal facilities at the proposed Second Street bus terminal.

Maximum rush hour loadings have been estimated to determine generally the pattern of operation at 1970 traffic levels. Maximum volume of passengers on individual routes passing points of maximum loading during a single hour of the peak period are estimated as follows:

| | |
|---|---|
| Bayshore Express Bus | 3,600 |
| Mission Rapid Transit | 8,800 |
| Market Street-Twin Peaks Rapid Transit | 8,100 |
| Geary Express Bus | 2,900 |
| Richmond Express Bus | 2,600 |
| Sunset Express Bus | 2,600 |

Assuming the use of rapid transit cars conforming generally to the modern P.C.C. type street cars, it is estimated that 98 cars per hour would be required on the Mission route and 90 cars per hour on the Market-Twin Peaks route. It is recommended that the Market Street terminal operation east of Van Ness Avenue be established on the basis of 40 trains per hour. This would be a combined headway of 90 seconds and a headway of three minutes on each of the rail rapid transit routes. This would result in the operation of five car trains on the Mission Freeway route and four to five car trains on the Market Street route.

Traffic developed on the Bayshore express bus line would require the operation of fifty-five 44-passenger buses. Ninety large 55-passenger buses per hour would be required to serve the three express routes proposed for operation through the Post Street subway, which would furnish a frequent and efficient service with a combined headway of 40 seconds. Headways on the Geary, Richmond and Sunset express bus routes would be approximately two minutes, thus assuring not only a fast but frequent service for these districts.

Estimated Costs

Preliminary estimates of cost have been made, based on present labor, material and equipment costs for subway and other construction involved in this program. Estimates include all preliminary engineering and other incidental and overhead expenses, and also a liberal allowance for contingencies. Subway estimates include the cost of maintenance of traffic during the construction period; all expenses in connection with the removal, maintenance and restoration of underground utility structures, as well as cost of underpinning and supporting adjacent buildings in those locations where such work is required. The estimates also include costs of all fixed subway equipment, including track, signals, power, communication, emergency alarm, ventilating, escalator, lighting and station facilities; in other words, all of the equipment and all of the appurtenances required to complete these projects ready for operation.

In the case of the Mission rail rapid transit route, all additional costs for right-of-way and construction over and above those that would have been involved in building a freeway (with no provision for rail rapid transit) have been included. Thus, the total cost of the combined project will be the sum of the rail rapid transit figure below and the estimated cost of freeways set forth in Chapter II. The estimates for the transit portion of the cost of freeways on which express bus service is recommended, have been made through a similar allocation of costs. The transit totals represent those figures over and above those which would have been involved in a simple freeway in which no special provision is made for express bus facilities. Summaries of the estimates of cost are, as follows:

Market Street Subway

| | |
|---|---|
| From incline just west of Van Ness Avenue to downtown terminal | $26,500,000 |
| From Van Ness Avenue to Twin Peaks Tunnel | 14,000,000 |
| From West Portal to Eucalyptus Drive | 12,000,000 |
| Total - Market Street Subway | $52,500,000 |

Mission Rapid Transit

| | |
|---|---|
| Subway from Market Street and Van Ness Avenue to a connection with the depressed freeway near 16th Street | $ 7,000,000 |
| Additional cost of right-of-way and construction required for 2-track railroad in the Mission Freeway center mall from 16th Street to southwest terminal, including all stations and terminal facilities | 4,000,000 |
| Total - Mission Rapid Transit | $11,000,000 |

Profit - Fiscal Period Ended

Less Taxes

Profit - Before Income Taxes

Add Profit Transfer:

Interest Income Less Other

Expense or Contribution Rate One-
Quarter Less Than Rate Applied
Against Income for Tax Purposes

Profit - Before Income Taxes

Less Taxes (Net of Tax Loss Credit
if Operating)

Profit - After Income Taxes

Add Net Loss Credits to Tax Basis Income
from Most Profit to Contingency Reserve

Profit - Before Income Taxes

Profit - Fiscal Period Ended

Less Taxes

Profit - After Income Taxes

Add Profit Transfer:

Interest Income Less Other
Expense or Contribution Rate One-
Quarter Less Than Rate Applied
Against Income for Tax Purposes

Profit - Before Income Taxes

Less Taxes (Net of Tax Loss Credit
if Operating)

Profit - After Income Taxes

Add Net Loss Credits to Tax Basis Income
from Most Profit to Contingency Reserve

Profit - Before Income Taxes

| | |
|---|---|
| Central Freeway | |
| Additional cost of express bus facilities | $ 100,000 |
| Panhandle Freeway | |
| Additional cost of express bus facilities | 200,000 |
| Richmond Freeway | |
| Additional cost of express bus facilities | 100,000 |
| Sunset Freeway | |
| Additional cost of express bus facilities | 200,000 |
| Post Street Subway | |
| A 2-lane vehicular tunnel complete with ventilating facilities, stations, escalators, including connections to the Central Freeway and Geary Street on the west and to the off-street bus terminal east of 2nd Street and to an incline in 2nd Street just north of Howard Street on the east | 18,500,000 |
| Total Cost of Entire Rapid Transit Program | $82,600,000 |

Equipment

It is estimated that 170 cars will be required for the Market and Mission rail rapid transit operations as of the year 1970. This equipment will cost a total, estimated at present market prices plus 10 per cent for contingencies, of approximately $6,800,000. No estimate has been projected of the bus equipment required for the recommended express bus lines. This equipment will be similar to that utilized in local operations. Large buses with seating capacity of 55 or more are suggested, however, for the operation of the Geary, Richmond and Sunset express services. The operation of these express routes will, as a matter of fact, reduce the system-wide equipment requirements due to the substantially increased speeds of the express buses operating over freeways as compared to present operation over normal streets.

Stage Construction Recommended

The largest single investment required to complete the rapid transit program recommended is the Market Street subway, involving a grand total of $52,500,000. It is recommended that this large project be undertaken in three stages as follows:

Stage 1

Complete the section east of Van Ness Avenue at a cost of $26,500,000.

Stage 2

Extend the subway along Market Street to Twin Peaks tunnel at a cost of $14,000,000.

Stage 3

Complete the subway between the west portal of the Twin Peaks tunnel and the underground terminal facilities projected beyond Eucalyptus Drive at a cost of $12,000,000.

Those rapid transit projects which are a part of joint highway-transit projects must necessarily be programmed to conform to the stage construction recommended for the freeway program.

The Post Street subway is logically the final rapid transit project to be undertaken. In our judgment it will be required before the year 1970. Upon the completion of the freeways over which the express buses will operate, interim routings over the surface streets in the downtown districts must be utilized. Building of the Post Street subway construction can be postponed until such time as definite need for this improvement is experienced.

It is our opinion that the east section of the Market Street subway should be undertaken in the first stage of this overall program. Before the completion of the present transit modernization program, it will be desirable and necessary to relieve Market Street of its extraordinary load of transit vehicles. This subway section will provide a substantial improvement in public transit to rapidly developing and populous areas south and west of Twin Peaks - in the absence of which there would be an unnatural and unhealthy increase in the use of private automobiles with a further load on the downtown street system.

Financing Problems

The overall transit program recommended for completion will involve an outlay approaching $90,000,000. This is a large expenditure, but based on the experience of other metropolitan centers, is one which can be financed by San Francisco readily within the twenty-year period suggested. The total outlay will average approximately $4,500,000 per annum. This large investment can be financed in three ways:

(1) Through the issuance and sale of full faith and credit bonds, or

(2) From revenues of the Municipal Railway, or

(3) By a combination of both.

Experience is other cities indicates a leaning toward the use of general funds to finance the major portion of the heavy capital outlays involved in rapid transit development. In New York, Philadelphia and Chicago, the original investment was made out of general funds on the basis, however, that a return would be paid out of the earnings of the transit facility. While some small amounts have been repaid to the general funds in all three cities, the total to date is almost insignificant.

In Boston, subways and tunnels have been financed through the issuance and sale of general obligation bonds. The operating company,

however, was required to assume the full annual interest and amortization costs on these investments, so that in effect, they have been supported by the car riders. In Toronto, plans have almost been completed by the Transportation Commission for the construction of its first rapid transit subway. This project will be financed out of surplus earnings now aggregating some twenty million dollars. Virtually all of the remaining cost will be supported by car riders out of future earnings. The contribution of the public at large in Toronto is almost negligible.

There has been general agreement in most of the cities mentioned that all of the fixed subway and transit equipment, such as track, power, communication, signal and bentilating facilities, as well as the investment in rolling stock, properly should be a charge on the operation of the transit system and supported by the car riders.

On the other hand, there seems to be a growing opinion that a transportation subway is, in reality, nothing but an addition to the street facilities. It increases the capacity of a street by expansion vertically instead of the conventional widening at street level. From such point of view it is a logical general public improvement and might properly be financed through the issuance and sale of general obligation bonds.

In support of this suggestion, it might be noted that many large taxpayers, particularly those with properties in the downtown district and near intermediate rapid transit stations, throughout the city, benefit directly from improvement of transit facilities. An improved transit system which would provide much more convenient, direct and speedy transit between outlying and intermediate sections of the city and the downtown district, will have a marked influence on future activities in the various commercial and merchandising institutions in these areas. Considered in that light, it would seem appropriate that they should assume some substantial share of the cost of providing such system.

The determination of the policy to be followed in the financing of the transit program is obviously a legislative and administrative one. The above discussion is not construed to be in any sense a recommendation of the consultants, but merely a discussion of policies which have been considered elsewhere in similar situations.

## Approval of the Rapid Transit Pattern

The pattern of the complete rapid transit system should be established now to provide a basis for the ultimate development. The plans for freeway construction, which are already under way, should include specific provision for rapid transit. It is vital that there be agreement on and approval of a comprehensive transit system for San Francisco to provide a base for all present and intermediate developments.

## Benefits of the Proposed System

The most direct benefit to the traveling public of the proposed rapid transit system would be the material time savings possible on trips to the outer portions of the urban area. Running time studies on the present system made in 1942 have been compared with running times computed for the proposed system. The reductions in travel time shown in the following tabulation are striking:

## 1942 TRAVEL TIME ON MUNICIPAL RAILWAY COMPARED WITH ESTIMATED TRAVEL TIME AFTER COMPLETION OF RAPID TRANSIT SYSTEM

(Tabulation shows running times from Montgomery Street to destinations indicated. All travel times and savings shown in minutes).

| Destination | Travel Time - 1942 | Estimated Rapid Transit Travel Time | Estimated Saving in Travel Time |
|---|---|---|---|
| Bayshore and 3rd Street | 28 | 21 | 7 |
| Mission and Cortland | 32 | 13 | 19 |
| Alemany and Capitol | 52 | 20 | 32 |
| Castro and 17th Street | 25 | 10 | 15 |
| Ocean and Junipero Serra | 40 | 17 | 23 |
| Lincoln Way and 19th Avenue | 38 | 16 | 22 |
| Fulton and 8th Avenue | 25 | 14 | 11 |
| Geary and Presidio | 20 | 12 | 8 |

The Municipal Railway would benefit in many ways from the proposed rapid transit operation. Greater patronage of the system would increase gross revenues. At the same time, operating costs would be reduced by the economies of high speed operation with large transit vehicles.

The proposed subways would decrease the number of transit vehicles operating on the downtown streets by almost half. The motor and trolley buses operating on the local routes, therefore, would be able to render more attractive and more economical service.

General traffic conditions throughout the city and particularly in the Metropolitan Traffic District, would be vastly improved. This would result, first, from the fact that large numbers of people would be induced to use public transportation rather than their own automobiles. Secondly, there would be some reduction in the volume of transit vehicles operating on the main radial thoroughfares as well as on the downtown streets.

III TRANSIT

14 PLATE

# MARKET STREET

SUBWAY DEVELOPMENT WOULD MAKE THIS TYPE OF TREATMENT POSSIBLE

# CHAPTER IV

## BAY AREA TRANSPORTATION - SAN FRANCISCO TERMINALS

The development of a long range plan for public transit, highways and related facilities in the City and County of San Francisco requires general consideration of regional transit problems and detailed study of those regional public transit routes directly linking downtown San Francisco with all the other major residential, commercial, industrial and educational centers in the entire Bay Area. Studies have been made, therefore, of existing transit facilities throughout the metropolitan area to determine the most desirable type of operation, both at present and in the predictable future, as a preliminary to development of plans for adequate terminal facilities in downtown San Francisco, coordinated with local and express transit lines serving all of San Francisco.

### PRESENT CONDITIONS

The major traffic movement in the region is that between the populous East Bay cities and downtown San Francisco over the existing Bay Bridge. The history of the growth of vehicular traffic over this structure and forecasts of probable future increases in traffic have been covered in numerous reports. Vehicular traffic on the normal weekday has now reached a total of about 70,000. During morning and evening rush hours, a condition of saturation has been reached with the result that there are constant and irritating delays to the free flow of traffic. During the past few years there has been common agreement as to the need for an additional crossing between San Francisco and the East Bay area.

The layout of the terminal facilities and ramps in San Francisco has resulted in a dangerous conflict of traffic between the principal exit ramp at First and Clementina Streets and southbound traffic on one-way First Street destined for the principal entrance ramp at Fremont and Harrison. This unfortunate situation has been given much consideration and will undoubtedly be corrected in connection with the construction of a second bay crossing, regardless of its location.

#### Key System

Public transit service to virtually all of the East Bay area is provided by the Key System. This company furnishes transbay train service and transbay motor coach service to the Bay Bridge Terminal at Mission and First Streets and in addition, numerous local lines in and through the East Bay cities proper. The original pattern of transbay service was trunk line operation. Trains operated over the surface of the streets in Oakland, Berkeley and nearby cities, to the bridge approach near San Pablo Avenue and 40th Street, and thence on a completely grade separated structure to the San Francisco terminal.

Five of these routes were still in operation during the summer of 1948. Service was operated in long trains at infrequent intervals ranging from 10-minute headways during rush hours, on the A line along 12th Street in Oakland, to 15, 20 minute or even greater rush hour headways on the other four routes. Base service is provided at considerably longer headways.

With the advent of new ownership and management of the Key System a few years ago, a program of conversion of transbay rail service to through motor bus service was inaugurated. In 1948, seven such services are operated between various feeder and distributor areas in East Bay cities and the San Francisco terminal. A more frequent service is operated over these routes than that provided by the former train service. The buses are confined to the lower deck of the Bay Bridge, however, and share this narrow roadway with a large volume of truck traffic so that the travel times are far from satisfactory.

No provision was made in the original plan of the Bay Bridge Terminal for bus operation of this character. As a result, the operators have improvised loading and unloading facilities, utilizing for this purpose public sidewalk and roadway areas around the terminal building - an extremely unsatisfactory arrangement both from the viewpoint of the other users of the streets and the passengers. An inspection of this area during any typical weekday evening rush hour, revealing the long lines of passengers standing on the sidewalks waiting an opportunity to board buses which are cluttering up the roadways during the somewhat extended periods required to take on full loads, proves the very definite need for radical improvement of this situation.

Other Suburban Service

First class railroad suburban service is operated by the Southern Pacific Company between suburban centers in the south Peninsula area and downtown San Francisco. This operation - largely over a grade separated right-of-way - is along the main line of the railroad over tracks and roadbed second to none. The coach equipment operated and travel speeds are equal to the best rail suburban service in other metropolitan areas, and superior to most.

The rail trip is terminated at the passenger station at Third and Townsend Streets, built over thirty years ago. While the facilities in the station proper are reasonably adequate, the location of the terminal is seven long blocks or five-sixths of a mile south of Market Street. Passengers are delivered to the terminal by eight to ten car suburban trains, resulting in concentrations of traffic too large to be handled by the street car and bus services now operated by the Municipal Railway. The lack of storage facilities to provide sufficient equipment to deal with such traffic results in long queues of passengers awaiting an opportunity to board street cars or buses to their ultimate San Francisco destinations.

To provide data not elsewhere available, with references to the traveling habits and needs of suburban passengers, an origin and destination survey was conducted by a staff furnished by the four cooperating city departments, working under the supervision of the consultants, on January 20 and 21, 1948.

A report in which the collected data were compiled, summarized and charted was published in April 1948. This survey information was utilized in the planning of distribution facilities for passengers utilizing the Southern Pacific service as well as the two Greyhound bus terminals.

In addition to the service furnished by the Key System between the East Bay Area and downtown San Francisco, certain of the outlying communities in that area are served by Greyhound buses terminating at the existing bus depot at Seventh and Mission Streets. Similar bus service is furnished communities on the Peninsula lying to the west of territory convenient to the Southern Pacific Railroad. These buses are routed along the Bay Shore Highway and also over the El Camino Real Gateway to the terminal at Seventh and Mission Streets. Communities in Marin County are likewise served by Greyhound buses operating over the Golden Gate Bridge to the Seventh and Mission depot and to the Greyhound commuter bus depot at Sansome and Sacramento Streets.

Analysis of the San Francisco destinations of the Southern Pacific passengers and also those bus passengers terminating at the Sansome and Sacramento Street terminal, indicates that they are largely concentrated in the financial district centering along Montgomery Street, with a limited number of destinations in the shopping district to the west, and scattered destinations through the remainder of the central business district. Study of the destinations of those passengers delivered to the Seventh and Mission Street bus terminal, however, reveals a different pattern. The destinations of this group of passengers lie largely along Market Street between Van Ness Avenue and the Ferry Building, with only a limited number scattered through the remainder of the central business district and no large concentration in either the financial or shopping districts to the north of Market Street.

## RECENT PROPOSALS

As a result of the need for a second bay crossing and because of the direct concern of the Army and Navy Departments with this problem, a Joint Army-Navy Board was appointed on May 10, 1946 to review all phases of this problem in detail and report its findings and recommendations to the Federal Government. After a thorough-going study and an extended series of public hearings during which all previous proposals for the solution of this problem were considered in great detail, the Board submitted its report on January 25, 1947. The surveys made, the data collected and the tentative findings of the Joint Army-Navy Board have been of inestimable value to the consultants in reviewing this phase of the overall transportation problem.

In the findings of the Board, great emphasis was given to the need for development of adequate rapid transit facilities between San Francisco and the East Bay Area. It was pointed out that the lack of convenient public transportation was one of the prime factors in the vast increase in private vehicular traffic over the present Bay Bridge. Included in the report was a recommendation for the construction of a new transbay tunnel for the exclusive use of rapid transit trains articulating an extensive network of subways and surface rail extensions covering the more populous sections of the East Bay Area, with an elaborate pattern of subways in San Francisco proper.

The Board made a thorough study of the location of a second bay crossing, considering in some detail the previous suggestion for a second bridge closely paralleling the existing Bay Bridge, and for bridge or causeway-tunnel crossings at other locations both north and south of the existing structure. They found a number of advantages

in a location extending between Alameda on the east side and Army Street in San Francisco on the west side of the bay, and recommended the construction of a causeway-tunnel highway facility in such location.

The State Division of Highways made numerous studies of the bridge location problem. Their first findings, as published in a report dated January 31 1947, was for the construction of a second bridge located parallel to and north of the existing structure. This proposal met with considerable resistance from various groups, particularly in view of the recommendations of the Joint Army-Navy Board published about the same time, in which the Army Street southern crossing was recommended. Subsequently the State Department of Public Works announced its decision to build two additional crossings, one as proposed earlier, parallel to the existing bridge, and a second in the Army Street location recommended by the Army-Navy Board. During the past year the Bay Toll Crossings Division has been engaged in intensive studies of this problem, and on November 16 issued "A Report to Department of Public Works on Additional Toll Crossings of San Francisco Bay."

During the year 1947 a major thoroughfare plan was developed for the City of Oakland by Mr. Harland Bartholomew, Consulting Engineer. This plan included a pattern of freeways serving Oakland, Berkeley and other communities both to the north and to the south in the East Bay Area. We are advised that this plan for freeways has subsequently been officially adopted by the City of Oakland and we have utilized it, therefore, in determining the probable character and scope of the rapid transit service between the East Bay Area and San Francisco which ultimately may be developed.

## SUBURBAN TRANSIT

A study has been made of existing transbay services operated by the Key System, of the present population distribution, of the population distribution in various sectors of the East Bay Area as forecast for the year 1970, and of the pattern of freeways proposed for the East Bay Area which may reasonably be realized by the year 1970, and finally of the pattern of rail transit subways and service extensions proposed by the Joint Army-Navy Board. These studies were made to determine the practicability of rapid transit subways, the need for additional rail or other facilities for transbay public transit operation, the probable type of equipment, and the scope and character of service which can be supported by the traffic and which may reasonably be considered capable of accomplishment during the next twenty years or more.

### Key System

Estimates of traffic derived from the BAMTS data were compared with traffic on the several lines as reported by the Key System for typical weekdays during the year 1948 and found to be in general agreement. For study purposes, a tentative pattern of rapid transit operation was assumed in the East Bay Area along the several proposed freeways. Transbay traffic was allocated to a total of eight routes radiating from the east approach of the present Bay Bridge, four of which could be operated almost entirely over proposed freeways, and four of which could travel over freeways through a portion of their routes. Traffic which could be attracted to such operations was estimated, both at 1948 and 1970 levels.

Total transbay traffic on a typical weekday in the year 1970, assuming the present approximately equal division between automobile passengers and public transit passengers, was estimated at approximately 62,000 passengers each way daily. Maximum concentration on any single line was estimated at less than 13,000 passengers each way. Peak hour loadings along the heaviest freeway route in the year 1970 are estimated at less than 5,000 passengers per hour, a figure which is within the limits of practicable express bus operation. Total peak-hour transbay traffic in the year 1970 is estimated at 22,000 passengers.

This traffic can be carried by 220 cars operated in trains with average length of five and one-half cars on a headway of 90 seconds. It would appear from these calculations that the present two-track rail road on the lower level of the Bay Bridge will have capacity to handle all transbay public transit passengers as estimated for the year 1970, and in addition five-sixths of those who it is estimated will utilize private automobiles for their transbay travel in that year. In other words, the total capacity of a single track operated with forty ten-car trains per hour is approximately 40,000 passengers. Thus the adequacy of the present two-track rail facility is proven, and we recommend no additional rail facilities for transbay traffic.

The present transbay rail operation has many shortcomings however, which should be corrected. The infrequent service is a distinct element of inconvenience. The operation of long trains over public streets in the East Bay cities has obvious disadvantages. The desirability of modifying this operation so as to provide for a frequent, high-speed rail service between a conveniently located bus-rail transfer terminal on the Oakland side to the existing San Francisco terminal is evident from every viewpoint.

The widespread distribution of population in the East Bay cities can be best served by feeder bus lines operated over a well distributed pattern to a central location at the east approach of the Bay Bridge. These lines could be operated as express bus routes when and as the projected freeways are built. A modern, efficient transfer terminal can be constructed which would provide a cross-platform transfer from bus to train at no more inconvenience or loss of time than is involved in transferring from the local to express trains in the New York subways. Passengers would transfer from feeder buses to waiting trains, which, if operated on a 90-second headway as here recommended, would involve an average wait of only 45 seconds. The trains now operated on headways of 10 minutes, 20 minutes or more in the East Bay could be replaced with local or express buses operated at frequencies of two or three minutes, or even less.

The seven mile trip from the east bridge approach to the Bay Bridge Terminal in San Francisco should be made in new modern, lightweight, high-speed transit equipment with the operating characteristics of the modern PCC street cars, and similar generally to the rapid transit cars recently purchased by the Chicago Transit Authority. The travel time on such trains, with necessary revisions to the existing signal system, would be reduced to approximately 10 minutes.

Traffic conditions on the streets of Oakland and Berkeley will be much improved through the elimination of the existing unwieldly train service and the substitution of curb loading buses. Eventually, many of these buses will disappear from the local street system and will operate at higher speeds over the projected freeways.

There will be a similar improvement in San Francisco through the elimination of the present transbay bus service terminating on the public streets, roadways and sidewalks in the vicinity of the Bay Bridge Terminal. Passengers would benefit through provision of protected and covered stations as compared with standing in queues on sidewalks, as at present, while waiting an opportunity to board buses on one of the seven existing transbay bus lines.

There would be an advantage to the operators, and ultimately to the passengers, through reductions in operating expenses. The ultimate substitution of high-speed express bus service for the present train service on the streets of the East Bay cities would effect a marked reduction in operating expenses. Trunk line train operation at high speed as proposed, with new modern cars and signals, with no delays on the Oakland side for taking off or adding cars, would also accomplish appreciable decreases in costs. These economies would be directly reflected in the operating results of the Key System, and eventually would be passed on to the car riders.

Improved distribution of transbay passengers will be provided on the San Francisco side through the operation of cars in the proposed Market Street subway, providing delivery on Market Street by first class rail service operated at high frequencies. Convenient transfer facilities for passengers from transbay trains to subway cars is planned. Ultimately transbay passengers can transfer to the trolley buses or gas buses operated in the proposed Post Street subway by a walkway directly west of the existing Key System terminal connecting to the off-street terminal proposed on the east side of Second Street.

Southern Pacific Company

Trunk line suburban train service now operated by the Southern Pacific Company is first class in all respects, except the downtown terminal delivery. The great distance between Third and Townsend Streets and the majority of the destinations in the financial and shopping districts is aggravated by the lack of convenient local transit service to and from this terminal. Suggestions have frequently been made that this station be moved to a location fronting on or in the vicinity of Market Street. This possibility was examined and it was found that not even a small portion of the enormous capital outlay involved could be supported either from the standpoint of resulting public benefits or operating economies.

It is necessary and highly desirable, however, that improved service be provided for distribution of the suburban passengers to their San Francisco destinations. Such service is planned through the construction of an off-street bus terminal on the north side of Townsend Street opposite the concourse of the Southern Pacific terminal. Passengers would cross Townsend Street at a level just below the sidewalk, reaching a platform at the bus terminal, where they would board waiting buses. Bus operation to this terminal is proposed on Brannan, Fourth and Stockton Streets to provide direct delivery to the heart of

the downtown shopping district. Similar direct service is proposed along Brannan, Second and Post Streets to afford convenient service both to the financial district centering on Montgomery Street and to the shopping and theater district to the west. It is also recommended that the shuttle route now operated along The Embarcadero be routed along Brannan Street to this off-street terminal. Operation of these feeder and distributor services will provide adequate transit service to most of the destinations of the suburban passengers as determined by the origin and destination study conducted as a part of this survey.

Traffic conditions in the vicinity of the railroad terminal proper would be improved by the elimination of standing street cars in Townsend Street and substitution of off-street bus loading and unloading as proposed.

Suburban Buses

Reference is made to Chapter III on Local Transit and the proposed express bus operation along the Bayshore Freeway to an off-street bus terminal on Second Street and also to the rapid transit rail service proposed along the Mission Freeway and along the Market-Twin Peaks rapid transit route.

Such bus service as may be required by passengers to the San Francisco airport and points to the south along the west shore of the bay will be furnished by high speed express buses routed over the Bayshore Freeway. Adequate distribution in the downtown district will be afforded by their operation to and from freeway ramps on Seventh and Eighth Streets and thence along either Market or Mission Streets to the proposed Second Street terminal. Passengers from communities in the south Peninsula area not convenient to the Southern Pacific rail line, would be delivered by feeder buses operated over trunk line highways in San Mateo County either to the Mission terminal or to the Market-Twin Peaks subway terminal near Lake Merced. Here, bus-rail transfer stations are planned to furnish maximum convenience in transferring from feeder buses to high-speed rail cars or trains.

## SECOND BAY CROSSING

Present normal weekday traffic over the Bay Bridge totaling 70,000 vehicles is accommodated by two 3-lane undivided roadways on the upper deck and a single 3-lane two-way roadway for trucks and buses on the lower deck. These facilities are ample for non-rush hour traffic, but during periods of peak flow in the morning and evening rush hours, are admittedly inadequate.

Estimates of transbay traffic have been projected to the year 1970, based on forecasts of population, increased automobile ownership and use, and the present division of travel as between private automobiles and public transit. These estimates indicate a figure for transbay traffic totaling 115,000 vehicles on a normal weekday by the year 1970.

A second crossing in the southern location now under study, will immediately attract a substantial volume of traffic from the present structure during the morning and evening peak traffic hours. With the estimated gradual increase in total traffic, these diversions will gradually become greater. Detailed analysis of the origins and destinations revealed by the BAMTS have been made to determine the number of

motorists whose travel time would be reduced through the use of the proposed southern crossing. A further analysis covers the effect of the diversion of traffic from the congested roadways of the existing bridge during rush hours.

From these studies we estimate that the use of the southern crossing by the year 1970 will be such as to accommodate at least one-quarter of the total transbay traffic. If it were assumed that a large number of motorists would prefer to spend three or four minutes longer to secure the convenience and ease of a comparatively light-traveled roadway, the second crossing in the Army Street location would absorb a much greater proportion of the total traffic. It is our opinion that one additional crossing will be sufficient to meet all traffic requirements as they may develop in the next twenty years. There are a number of major factors which should be considered in the final determination of the important problem of location, including:

The effect on the downtown street system in San Francisco;

The effect on the overall development of the Bay Area;

The navigational hazards involved in the parallel bridge; and perhaps most important to all

The fundamental need for dispersion considered from a military viewpoint.

The last two considerations were discussed in detail in the Joint Army-Navy Board report and their findings on these matters are endorsed by your consultants. The views of the Navy Department were expressed recently in a letter addressed to the War Department by Rear Admiral D. B. Beary, Commanding Officer of the 12th Naval District, in which he stated:

"In particular, it is desired to emphasize opposition to the construction of a parallel bridge from the standpoint of national defense."

"The parallel bridge proposed violates the fundamental strategic principle of dispersion.

"It is believed that one modern missile landing at or near these parallel bridges would seriously damage or completely destroy these structures and deprive the City of San Francisco of direct lines of communications with the East Bay Area."

The Army Street location, in our opinion, provides the best opportunity for routing by-passable transbay traffic away from the congested portions of the Central Freeway which, as the traffic estimates for 1970 discloses will be the most heavily traveled freeway in the entire network. The Alemany Freeway when built, will provide direct connections to the Bayshore Freeway and to the Mission Freeway, thus affording a direct route to San Mateo County and all points in the south peninsula. Convenient access to the areas southwest of Twin Peaks and

to the Sunset District would be afforded by the proposed Circumferential Expressway. Destinations west of Van Ness Avenue could be reached conveniently by use of the Army Street thoroughfare, the Bayshore Freeway or the Mission Freeway, and thence over the Central Freeway or Panhandle Freeway, without imposing any additional loads on streets in the congested downtown area.

The trend in residential and industrial development on the west side of the bay is definitely to the south. The new East Shore Freeway and the location of the approach to the second crossing in Alameda would naturally serve as a spur to the development in the south sections of the East Bay Area. As a result, many thousands of new residents and workers in these areas would be convenienced by a crossing in the southern location. From the viewpoint of overall metropolitan area development, this location has significant advantages.

Southern Crossing Recommended

For the reasons summarized above, we endorse the location of the second bay crossing as recommended in the Joint Army-Navy Board report. The location of the Marginal Freeway along the main stem of the existing Bay Bridge approach has been suggested but it is of vital importance that this freeway should be extended to and along The Embarcadero so as to deliver traffic along the waterfront at a location north of Market Street.

Studies carried on by the State Division of Highways during the last year have been reviewed, from which it is evident that such extention can be planned and constructed without any interference with the essential functions of the several interchanges required in the Bryant-Harrison Street area. Virtually all of these studies are based on the assumption that a parallel bridge will ultimately be built. The determination of the exact pattern of these interchanges, the responsibility for assumptions in respect to a possible second parallel bridge, for the location of ramps and for the correction of existing traffic conflicts in this area, are not within the scope of the consultant's responsibilities.

As these plans take more definite form, however, they will be subject to review by the technical staffs of the four city departments at interest. It is suggested that their efforts may well be directed toward the accomplishment of a plan which will achieve the above objectives and provide for equalizing the load on the Market Street intersections by directing traffic to the greatest extent practicable to intersections west of Sixth Street and east of Third Street.

## TRUCK TERMINALS

Over-the-road and interstate truck operations are conducted from some thirty-nine terminals in San Francisco. Most of these facilities are located in the area south of Harrison Street, east of Potrero Avenue and north of 18th Street, convenient to the railroad freight terminals and warehouse facilities in this area. About one-third of them are located along or convenient to the waterfront. Only three small terminals are located in other areas, but these can be conveniently served by the Bayshore and Central Freeways.

Union truck terminals which have been considered in other cities offer a variety of advantages to the motor carriers themselves, and also to the general public. Primarily they would provide a number of motor carriers with central facilities through which over-the-road loads could be broken down, sorted, interchanged, loaded, and through a zone cartage system, picked up and delivered to consignees within the city. In such a specially designed terminal, platform operations would be efficient. Coordinated collection and delivery service would improve efficiency both at the platform and on the street.

For example, many individual terminals are cramped and have inefficient layouts. Sudden rushes alternate with slack periods so that platform labor cannot be utilized to best advantage. In a union truck terminal, platform labor usually could be kept employed at useful work. Moreover, the larger volume of freight might warrant investment in conveyors and other specially designed labor saving equipment. Thus platform handling costs in a union truck terminal can be materially lower than in the usual individual truck terminal.

Development of one or more union truck terminals would be of advantage to shippers. Shipping department congestion could be materially reduced and interruptions minimized if one or two trucks handling all deliveries and shipments called daily instead of a dozen or more operated by separate carriers. A union truck terminal would thus permit more efficient use of shipping department personnel and hence decrease shipping department costs.

On tonnage moving out of the city, shippers' own trucks also build up extra mileages on city streets and waste time delivering their freight to a number of individual truck terminals. A union truck terminal, where all shipments for a number of motor carries would be accepted at one point, would save the shipper equipment and labor, and speed up the movement of his freight.

In detailed studies made in other cities it was found that trucks of various operators dispersed from these separate terminals frequently follow each other over the same streets and deliver freight to many of the same consignees on the same day. These overlapping pick-up and delivery movements are typical of trucks of over-the-road common carriers whose partially loaded trucks constantly retrace routes of competitors.

Our general studies indicate that the location and operation of over-the-road truck terminals in San Francisco is superior to that found in most other large American cities. The present concentration of terminals in a single area is a definite advantage.

The Port Authority of New York is now constructing new modern union truck terminals in carefully selected locations on Manhattan Island and in the heavy industrial New Jersey area. The results of these projects will be of interest to San Francisco. The New York operations will provide a definite measure of the justification for the expenditure of public funds for these purposes. It is our recommendation that the New York results be awaited before determining an ultimate policy on this problem in San Francisco. In the meantime, it is suggested that over-the-road truck operators be encouraged in every way possible by public authorities to consolidate and simplify their terminal operations.

# CHAPTER V

## IMPROVED TRAFFIC CONTROL

While the major portion of the work assigned to the consultants consisted in the development of long range plans for projects involving heavy capital outlays, one important assignment was to study all phases of present traffic and to present recommendations for the improved functional use of the existing street system. Voluminous data collected heretofore have been reviewed in detail. These data were supplemented by numerous field studies carried on during the progress of the survey through the cooperation of the four city departments and the State Division of Highways.

Certain improvements in the functional use of the streets were recommended in the report submitted on March 5, 1948. Additional recommendations, covering one-way street operation, through streets, modern traffic signals, traffic organization and administration, and miscellaneous related improvements are submitted in this chapter.

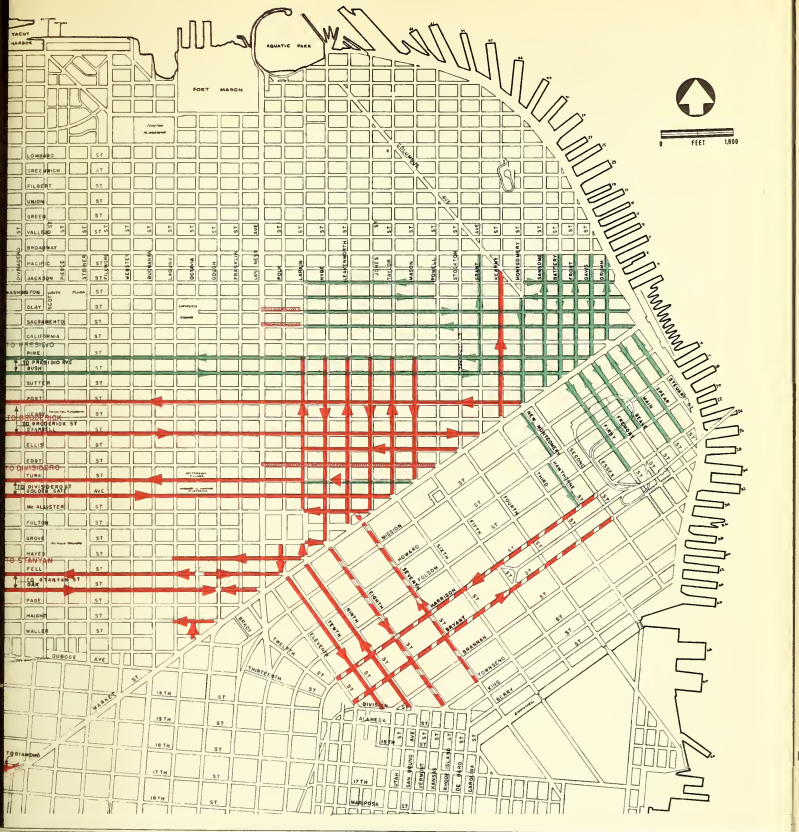
### ONE-WAY STREET PLAN

The unique pattern of streets in downtown San Francisco causes unusual problems of traffic control which are particularly susceptible to improvement through installation of one-way streets. The series of five-point intersections along Market Street would be specially benefited through one-way operation by reduction of potential conflicts between vehicular paths and simplification of traffic signal timing. Under present operation, traffic enters each intersection sumultaneously from three streets, all receiving the go signal at once, causing 26 points of conflict between vehicular paths at intersections between Van Ness Avenue and The Embarcadero. Under the one-way plan, one or more of the five legs will be made one-way, thus reducing the number of entering and turning movements and eliminating conflicts at all intersections.

The abnormally small blocks (300 by 500 feet) in the area north of Market Street invite the extension of one-way operation to eliminate unnecessary conflicts and delays.

An extension of the one-way system in the Metropolitan Traffic District is proposed, therefore, to include all the north and south streets between (and including) Larkin and Mason, and - except for the public transit route streets, California, Sutter, Geary and Eddy - all of the east and west streets. Several one-block long sections of one-way street at five-point intersections on Market Street are proposed, as shown on Plate V-13. Such control is essential to satisfactory traffic control along and across Market Street as recommended.

The short sections of one-way streets in the Civic Center area are established primarily to improve the Market Street intersections, and at the same time to accommodate the routing of trolley coaches from the McAllister and Hayes lines into and out of Market Street without conflict. Therefore, the streets surrounding the Civic Center Plaza and the City Hall have been left in two-way operation so that theMcAllister trolley coaches can operate southbound via Larkin Street into Fulton Street, and so that the Hayes trolley coaches can operate via Grove

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OCTOBER 1948

# PLAN OF ONE WAY STREETS

EXISTING ONE WAY STREETS

PROPOSED ONE WAY STREETS

PROPOSED TWO WAY STREETS (EXISTING ONE WAY)

PROPOSED ONE WAY STREETS AFTER COMPLETION OF BAYSHORE FREEWAY

TRAFFIC CONTROL

V

13

PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

and Larkin Streets to Fulton Street from which street they can enter Market Street without a left turn conflict. The total width of the streets in the Civic Center makes such two-way operation feasible.

The plan includes Ninth and Tenth Streets, which carry heavy traffic volumes to and from the south. It is proposed that one-way operation be ultimately extended to include Seventh, Eighth, Bryant and Harrison Streets. This, in our opinion, will be required to absorb the impact of the concentrated traffic load caused to be borne by these streets by the Bayshore Freeway when it is completed.

West of Larkin Street, the plan carries Post and O'Farrell to Broderick Street (where they connect into the widened section of Geary Boulevard); Turk Street and Golden Gate Avenue to Divisadero Street, and Fell and Oak Streets to Stanyan Street. Note that it is proposed to reverse the existing direction of Turk Street, now a one-way thoroughfare.

The purpose of the reversals in Fell and Oak Streets is explained as follows: Oak Street traffic is carried eastbound to Octavia or Gough where a left turn to the north and then a right turn onto Fell will permit such traffic to proceed north on Van Ness or across Market Street with no conflicts. The reverse movement, from Ninth, Market or Van Ness, involves a westward movement on Hayes, turning south on Octavia or Laguna, and turning right to proceed westerly on Fell Street.

This jog in both one-way streets is made necessary because of the relation of Oak and Fell Streets to Ninth and Tenth Streets, plus the inadvisability of bringing Oak Street traffic into the intersection at Van Ness, Market and Oak. This junction is particularly hazardous and congested, and this one-way plan aids considerably in the plan for improving traffic conditions on both Market Street and Van Ness Avenue at their junction.

It is proposed that diagonal streets be constructed ultimately between the intersection of Hayes and Gough Streets and the junction of Fell and Octavia Streets; also between Gough Street at Fell Street and Octavia Street at Oak Street; to provide an easy jog connecting Oak and Fell Streets and Fell and Hayes Streets. The property between Octavia and Gough Streets is proposed for acquisition as part of the right-of-way required for the proposed Central Freeway. Therefore it would seem feasible to acquire this property and build the diagonal streets at an early date.

Haight Street is proposed as one-way for two blocks west of Market Street to facilitate intersection control at Gough and Market Streets as well as to provide a convenient route for westbound Market Street motorists desiring to proceed south on Guerrero Street. Since traffic signals are proposed for the intersection at Laguna, Market and Guerrero Streets, a left turning movement off Market Street here would cause hazard and delay. Therefore such movement should be made by proceeding west on Haight Street, then south on Laguna Street and across Market Street, eliminating the present traffic conflict.

Advantages of One-Way Operation

The one-way plan will increase the comfortable operating capacity

of the streets more than 50 per cent above that possible with the present two-way operation. This results from fewer conflicts caused by turning movements and also from the fact that 44-foot roadways such as Larkin, Hyde, Leavenworth, Jones, Ellis and McAllister provide for only two 15-foot lanes for moving traffic with two-way control, but provide three 10-foot lanes for moving traffic with one-way control.

The Portland City Traffic Engineer has reported, for instance, that the establishment of Southwest Jefferson and Columbia Streets as a pair of one-way streets in that city, resulted in a 60 per cent increase in traffic volume within one year. The 1938 report of the Highway Research Board states that traffic volumes increased 93 per cent on the one-way street systems of six cities studied while city-wide volumes increased only 15 per cent.

Of the 17 intersections in the entire city with the highest frequency of collisions reported last year, six were on Market Street. The most hazardous intersection in the city was at Market and Sixth Streets. Market at Third was third in the order of dangerous locations. The one-way plan should reduce these accident frequencies by eliminating 25 of the present 26 conflicts at Market Street intersections.

Traffic accidents are reduced substantially due to the decrease in the possible number of conflicts. A conflict point is where one line of vehicles crosses or joins another line of vehicles. The present points of conflict in the area surrounded by Larkin, Pine, Kearny and Market Streets would be reduced by one-third.

Possible points of conflict between pedestrian and automobile traffic are also reduced. At a signalized junction of two one-way streets, two pedestrian lanes are completely free of conflict in each signal cycle, whereas under two-way operation there are always troublesome conflicts between pedestrians and left-and right-turning vehicles.

One-way street systems function so much more smoothly that generally fewer traffic officers are needed. This is directly attributable to the reduced number of possible conflicts. Philadelphia reports a reduction of 75 per cent and New York of 50 per cent in police manpower on traffic direction following installation of one-way streets.

Traffic signal timing is greatly simplified on a one-way street. Frequently, the start of the "go" at each intersection can be timed to afford a continuous non-stop movement of traffic along the street at any desirable speed, regardless of spacing of signalized intersections. Thus there need be but little vehicular delay due to signals. However, under two-way operation a compromise plan must be worked out, to afford the best possible traffic progression in both directions simultaneously. Where block lengths are short, such as on the streets north of Market, the compromises made to suit both directions of traffic simultaneously, seriously limits the possibilities for progressive movement.

Speed and delay studies made of automobile travel on Post Street between Divisadero and Kearny Streets in April 1948, showed that three-fourths of the traffic delay on this important east-west street resulted from waits for signal changes. The one-way plan, by permitting progressive movement, will practically eliminate this type of delay. It is estimated that the average speed on Post Street would be increased 20 per cent by this action alone.

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OCTOBER 1948

# THROUGH STREET TRAFFIC CONTROL PLAN

TRAFFIC CONTROL V

14 PLATE

CONTROLLED PRIMARILY BY TRAFFIC SIGNALS PLUS STOP SIGNS ON SIDE STREETS AT NON-SIGNALIZED INTERSECTIONS.

PROTECTED BY STOP SIGNS ON SIDE STREETS PLUS FEW SIGNALIZED INTERSECTIONS.

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

## IMPROVED TRAFFIC CONTROL FOR MARKET STREET

Downtown Market Street is, and of necessity always must be, the public transit trunk line in the San Francisco Central Business District. The importance of Market Street as a public transit terminal required the preparation of a plan for improved functional use of the thoroughfare as a part of the first stage transit routing plan recommended in the report of March 5, 1948.

One major objective of the new plan was to increase capacity and to speed up traffic on Market Street. This has been furthered already through institution of a plan of staggered transit stops based on the plan recommended by the consultants.

The benefits of this plan, as measured by reduction in delays to transit vehicles, were proven by speed-delay tests made before and after the adoption of the staggered stops. The tests indicate that the overall speed of off-peak eastbound trips was increased approximately 12 per cent. Westbound street car speeds were increased 24 per cent and 42 per cent for off-peak and peak trips respectively. Westbound motor coach speeds increased 5 per cent and 29 per cent respectively, over the former operation. Greater time savings could be obtained for westbound street cars and motor coaches if adjustment in signal timing were made.

### Intersections Narrowed

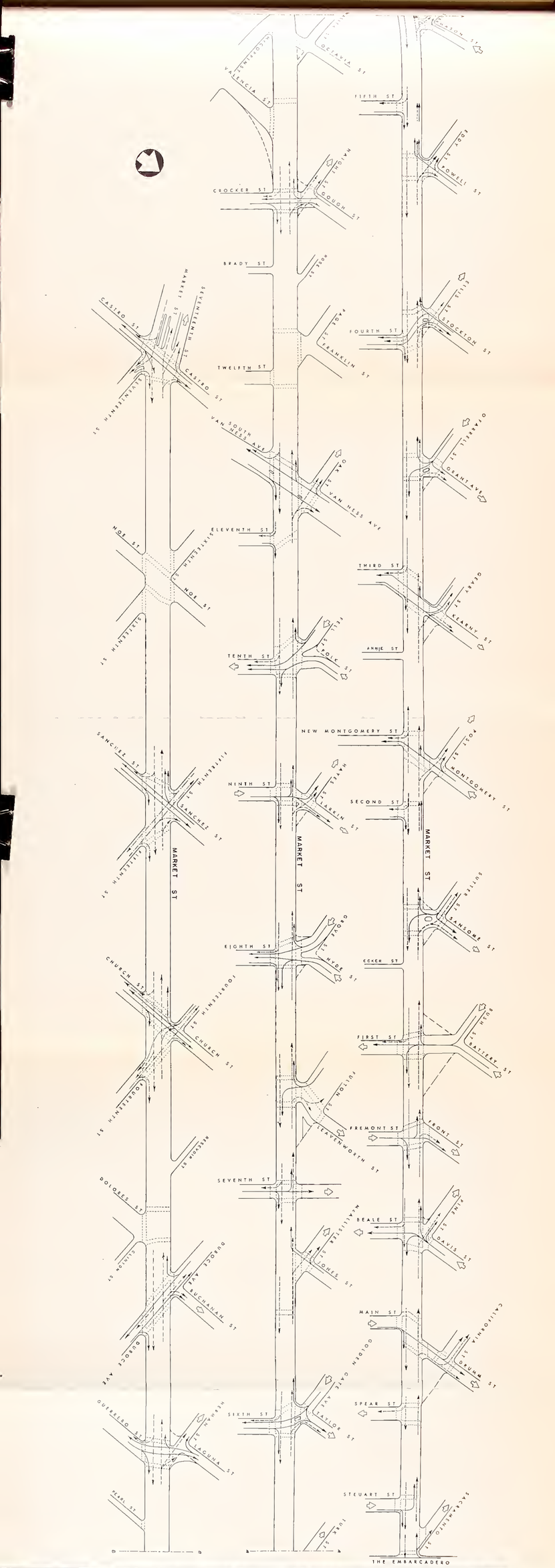
Another objective of this proposed plan is to afford better protection for pedestrians. At present many intersections present considerable street area for the pedestrian to traverse. The proposed plan shows construction of islands and extensions of curb lines to narrow these intersections. Not only are pedestrians afforded more protection, but intersection clearance time for vehicles is lessened and turning movements confined and better channelized, which makes for safer vehicular operation and increased capacity.

### Improved Traffic Signals

The traffic movements permitted during each of the signal phases at each intersection under the proposed plan are shown on Plate V-15. This traffic control eliminates intersection conflicts and provides a more uniform spacing of signalized intersections, thus simplifying the timing for progressive traffic movement.

The existing traffic signal timing plan is illustrated on Plate V-16. This time-space diagram was prepared from actual stop-watch recordings made in the field and is the timing pattern existing throughout most of the weekday. At certain periods when traffic is particularly heavy, police officers manually regulate the signals.

The bands extending diagonally across the diagram show paths open for movement of Market Street traffic with respect to time and space and illustrate the many stoppages of movement because of improper timing. Evidence of these stoppages is given by the data collected by field surveys made during March 1948. These checks showed that delays to street cars due to traffic signals during off-peak periods equalled passenger loading periods, and during peak hours, actually exceeded loading periods.

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TRAFFIC CONTROL V

15 PLATE

# MARKET STREET

## PROPOSED CHANNELIZING & SIGNAL PHASING

PHASE 1 – SIGNAL CONTROL

PHASE 2 – SIGNAL CONTROL

PHASE 3 – SIGNAL CONTROL

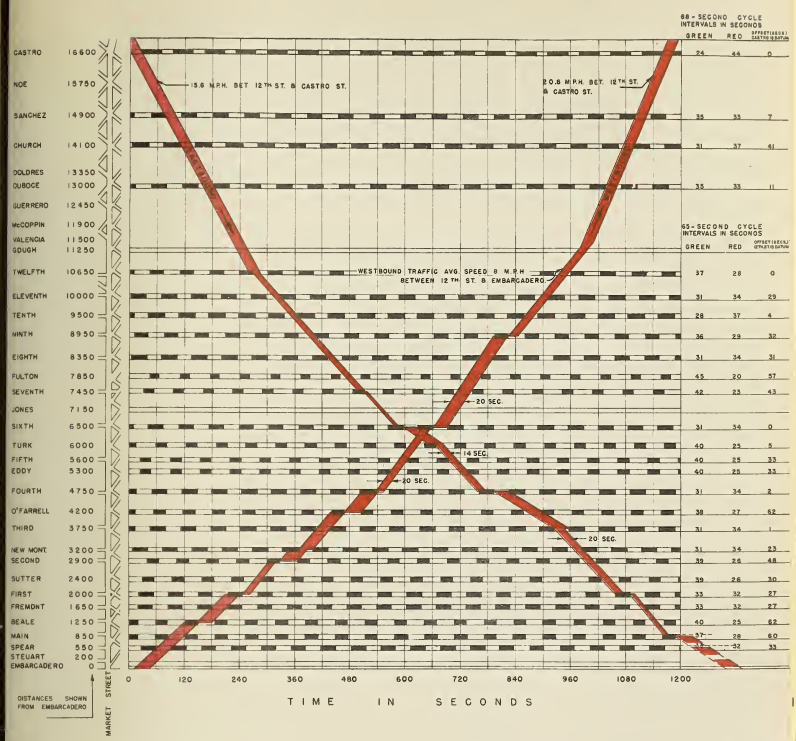
TRAFFIC ISLAND

CROSS WALK

ONE – WAY

OCTOBER 1948

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

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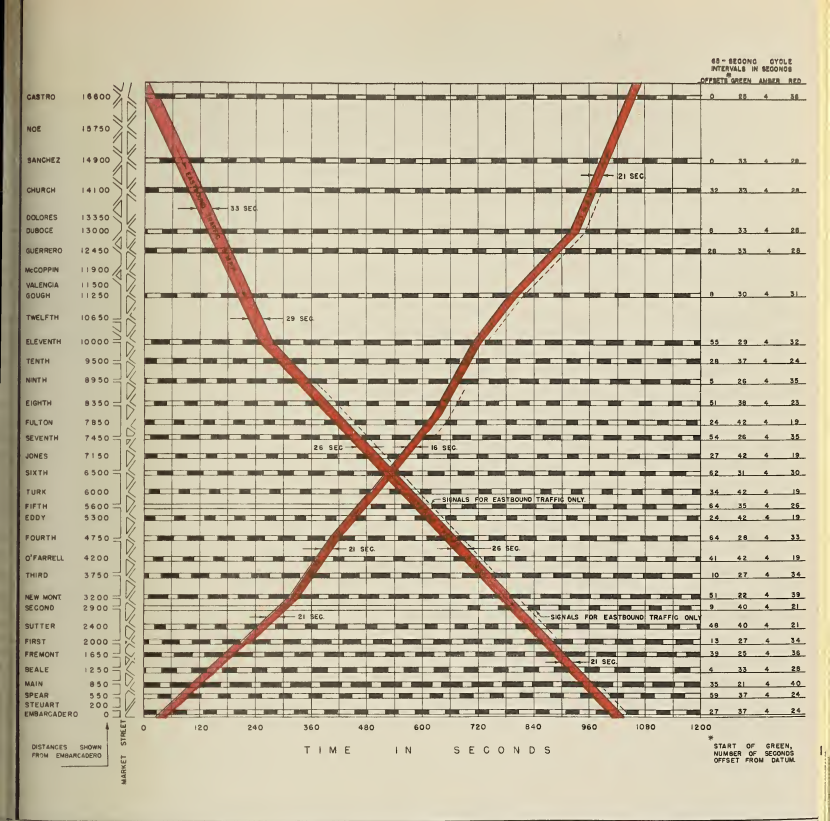
OCTOBER 1948

# EXISTING
# MARKET STREET SIGNAL TIMING

OFF-PEAK PERIOD 8:30 - 4:30

TRAFFIC CONTROL V

16 PLATE

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OCTOBER 1948

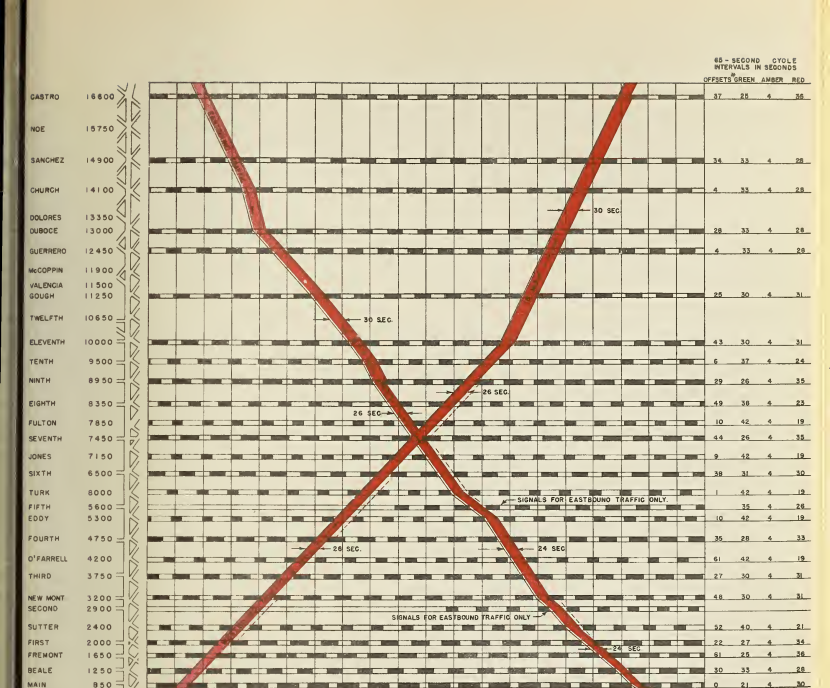
# PROPOSED
# MARKET STREET SIGNAL TIMING

## EASTBOUND
## PEAK FLOW PERIOD 7:00 – 8:30 A.M.

TRAFFIC CONTROL V

17 PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

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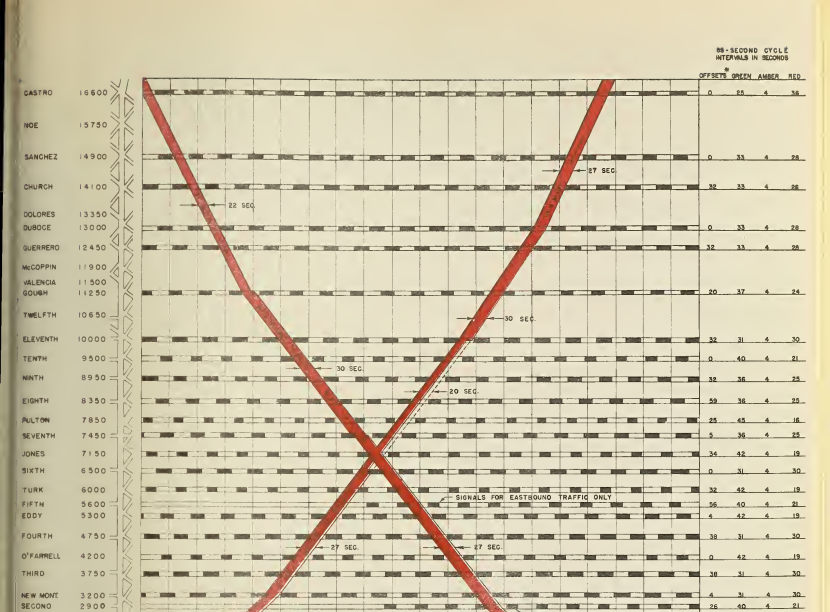
# PROPOSED
# MARKET STREET SIGNAL TIMING

WESTBOUND
PEAK FLOW PERIOD 4:30 – 6:00 P.M.

TRAFFIC CONTROL V

18 PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

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OCTOBER 1948

# PROPOSED
# MARKET STREET SIGNAL TIMING

## OFF-PEAK PERIOD
## 8:30 A.M. TO 4:30 P.M. & 6:00 P.M. TO 1:00 A.M.

TRAFFIC CONTROL V

19 PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

It is recommended that existing signals be replaced by modern flexible 3-light triple reset signals, located at intersections as shown on Plate V-15. Suggested timing plans are shown on the time-space diagrams which cover the three different traffic periods of the day - A.M. peak, off-peak and P.M. peak.

Four changes in location are proposed. Signals for westbound traffic at Second Street and at Fifth Street are omitted, to permit timing for progressive movement, and the Market Street signal stop and the pedestrian crossing now located at Jones Street is moved approximately 100 feet east to a mid-block location. This latter move is for the purpose of effecting even spacing of signal locations to permit timing for progressive movement. Signals are moved from 12th Street one block west to Gough Street, to permit better timing for progressive movement and to afford the control needed that will be required at Gough and Market Streets when Gough Street is extended south of Market Street.

Speeds of progression of all timing plans are designed to favor movement of public transit vehicles since they carry the bulk of the passengers on Market Street. The 1947 cordon count, for instance, showed that five out of six passengers on Market Street are carried by public transit vehicles. Also, private vehicles tend to travel for short distances only, turning on or off Market Street, thus making it unnecessary to provide a through band for long distances for private cars. Cycle intervals at individual intersections are based on relative entering vehicular traffic volumes per lane.

Shown in detail on Plate V-17 is the timing plan recommended for operation during the A.M. peak inbound traffic period from 7:00 A.M. to 8:30 A.M. A 26-second band of green is available for through movement at an average inbound speed of 9 miles per hour east of 11th Street and 18 miles per hour west of 12th Street.

The outbound transit vehicles carry relatively few passengers in the morning peak period; hence the westbound vehicles are provided with a narrower band width to give every possible advantage to vehicles moving in the heavier inbound direction. Plate V-18 shows the timing plan for off-peak periods. The designed speed of 11 miles per hour is higher than that planned for the A.M. peak hour except in the section east of Second Street. Cycle intervals vary from those in the peak periods to provide a greater length of interval for east and west movements along Market Street.

Shown on Plate V-18 is the timing plan for the afternoon peak flow period when the majority of vehicles on Market Street are westbound. The same principles are applied in signal control as in the morning peak, but in the opposite direction.

## THROUGH STREETS

Existing through street regulations have been reviewed in some detail with a view to the preparation of a plan compatible with present San Francisco traffic requirements revealed in the numerous traffic surveys and counts available to the consultants. These studies were carried on in close cooperation with the engineering staff of the Department of Public Works.

A through street is one at which vehicular traffic on intersecting streets or highways is required by law to stop before entering or crossing when stop signs have been erected. The purpose of such through street is to move through vehicular traffic with speed, comfort and safety.

Through street control is generally warranted when the volume of traffic during the major part of the day exceeds 300 vehicles per hour or 450 vehicles per hour during the peak periods. On lighter traffic streets such control may be justified by reason of the need to eliminate certain special accident hazards. Traffic signals are frequently installed on through streets where the traffic volumes are heavy, to eliminate extraordinary hazards, or to effect speed control or coordinated movement of traffic. All intersections on a through street should be controlled either by traffic signals or stop signs.

An unusually large number of intersections in San Francisco are controlled with four-way stop signs. Many four-way stop signs have been installed at intersections where traffic volumes do not warrant the interruption to traffic. As a rule, heavy intersecting traffic streams can be best controlled by traffic signals. There are isolated locations where traffic volumes may not justify signal control where four-way stops may be justified by considerations of safety.

It is suggested that at intersections of two through streets, where traffic volumes do not warrant traffic signal control, only the major through street should be protected by stop signs located on the minor street.

A through street plan for San Francisco has been completed by the consultants and is recommended for adoption - see Plate V-14. In preparing this plan, consideration has been given to the streets partially or wholly controlled by existing traffic signals and stop signs. Certain existing through streets have been retained in the plan to avoid disturbance to present driving habits which might not be fully justified if considered solely on the basis of traffic volumes.

It is recommended that a program of sign and signal installation and removal be undertaken to completely protect all intersections on the recommended through streets and to remove all existing stop signs and traffic signals elsewhere throughout the city.

The recommended plan shows certain through streets to be controlled mostly by traffic signals. It should be noted, in this connection, that traffic signals are neither necessary nor desirable at every intersection. Such wholesale installation of traffic signals at every intersection is not only expensive but usually reduces the capacity of the street substantially.

A number of the secondary thoroughfares included in the comprehensive trafficways plan may require through street traffic control in the future. This would be necessitated by heavier traffic volumes due to increased population, changing traffic patterns caused by the freeway network, or land redevelopment projects. No attempt has been made to predict those modifications, which properly should be determined by the City Traffic Engineer from year to year.

## ACCIDENT REDUCTION

During the year 1947, 24,233 vehicles and 1,640 pedestrians were involved in 13,210 reported collisions on San Francisco streets, resulting in 94 deaths, 4,485 personal injuries and property damage to approximately 25,000 vehicles. It has been estimated that those involved paid out some $2,750,000 in direct accident expenses.

While San Francisco's safety rating as established by the National Safety Council for the year 1947 was fourth highest of the fourteen cities in San Francisco's population group, San Francisco was rated considerably below par in traffic engineering, ten cities having better ratings than San Francisco and only two cities with lower ratings.

The detailed recommendations on problem intersections set forth in Appendix A are aimed primarily at building safety into streets and intersections based on sound principles of traffic engineering. Other recommended changes, such as administrative improvements, creation of through streets and construction of freeways will bring about tangible reduction in accidents.

The junction of any two streets is a focal point of accident hazard. Whereas, intersections comprise only about 10 per cent of the street area in San Francisco over half of the total collisions occur there, indicating a hazard about nine times greater at intersections than at other street locations.

In order to develop recommendations for engineering remedies to reduce accident frequency and traffic delays, the locations of highest accident concentrations were determined by a study of the Police Department accident report files. The following table shows the forty street intersections with the worst accident records in 1947. A detailed discussion of traffic engineering improvements for the six most hazardous locations is set forth in Appendix A.

REPORTED ACCIDENTS DURING THE YEAR 1947
AT FORTY MOST HAZARDOUS INTERSECTIONS

| Hazard Severity Rating* | Location | Number of Accidents | | | |
|---|---|---|---|---|---|
| | | Fatal | Pedestrian Injury | Other Injury | Property Damage | Total |
| 1 | Market at 6th | - | 14 | 7 | 22 | 43 |
| 2 | Howard at 3rd | - | 18 | 5 | 9 | 32 |
| 3 | Market at Van Ness | - | 5 | 7 | 35 | 47 |
| 4 | Market at 3rd | - | 10 | 8 | 16 | 34 |
| 5 | Howard at 6th | - | 16 | - | 11 | 27 |
| 6 | Market at Haight | - | 6 | 4 | 27 | 37 |
| 7 | Bayshore at Oakdale | - | 2 | 8 | 23 | 33 |
| 8 | Mission at 3rd | - | 5 | 5 | 20 | 30 |
| 9 | Market at 4th | - | 7 | 4 | 18 | 29 |
| 10 | Potrero at 24th | - | 3 | 4 | 28 | 35 |
| 11 | Mission at 6th | 2 | 8 | 1 | 17 | 28 |
| 12 | Harrison at 3rd | 1 | 4 | 5 | 13 | 23 |
| 13 | Harrison at 10th | - | 1 | 7 | 17 | 25 |
| 14 | Howard at 10th | - | 2 | 4 | 25 | 31 |
| 15 | Post at Van Ness | - | 2 | 3 | 26 | 31 |
| 16 | Third at Folsom | - | 8 | 3 | 5 | 16 |
| 17 | Market at 10th | - | 2 | 5 | 19 | 26 |
| 18 | Clementine at 1st | - | - | 7 | 19 | 26 |
| 19 | Golden Gate at Van Ness | - | 2 | 3 | 23 | 28 |
| 20 | Guerrero at 16th | - | 2 | 7 | 9 | 18 |
| 21 | Alemany at Geneva | 1 | 1 | 7 | 9 | 18 |
| 22 | Ellis at Van Ness | - | 5 | 1 | 17 | 23 |
| 23 | Cabrillo at 10th | - | 2 | 6 | 9 | 17 |
| 24 | 3rd at Evans | - | 1 | 3 | 21 | 25 |
| 25 | Irving at 19th | - | 3 | 4 | 12 | 19 |
| 26 | Potrero at 17th | 1 | - | - | -- | 21 |
| 27 | Potrero at 16th | - | 3 | 3 | 14 | 20 |
| 28 | Harrison at 6th | - | 2 | 4 | 14 | 20 |
| 29 | Buchanan at Post | - | 5 | 3 | 7 | 15 |
| 30 | Lincoln at 19th | - | 2 | 6 | 7 | 15 |
| 31 | Harrison at 8th | - | 1 | 6 | 10 | 17 |
| 32 | Golden Gate at Larkin | - | 1 | 4 | 14 | 19 |
| 33 | Fell at Van Ness | - | 2 | 3 | 13 | 18 |
| 34 | Divisadero at Geary | - | 2 | 3 | 11 | 16 |
| 35 | Army at Potrero | - | - | 5 | 9 | 14 |
| 36 | Howard at Fifth | - | 2 | 2 | 11 | 15 |
| 37 | Vicente at 19th | - | - | 5 | 7 | 12 |
| 38 | Bayshore at Visitation | - | 1 | 3 | 10 | 14 |
| 39 | Hester at Bayshore | - | - | 5 | 5 | 10 |
| 40 | Harrison at 7th | - | 1 | 4 | 4 | 9 |

*Rated according to total of personal injury accidents plus one-third of property damage accidents.

## Records published during the year 1947
### at Ennor Road Laboratories

| Number | Position | Genus | Number of Specimens | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1 | Harvest of 1947 | - | 14 | 7 | 21 | 44 |
| 2 | Harvest of 1948 | - | 18 | 5 | 3 | 26 |
| 3 | Harvest of the 1949 | - | 6 | 3 | 4 | 13 |
| 4 | Harvest of 1948 | - | 10 | 2 | 11 | 23 |
| 5 | Harvest of 1950 | - | 10 | 4 | 11 | 25 |
| 6 | Harvest of Oxbyke | - | 3 | 3 | 23 | 29 |
| 7 | Collected at Oxbyke | - | 3 | 8 | 21 | 32 |
| 8 | Station at Ord | - | 3 | 3 | 11 | 17 |
| 9 | Harvest of Ord | - | 3 | 3 | 14 | 20 |
| 10 | Harvest of 1949 | - | 3 | 3 | 14 | 20 |
| 11 | Station at Ord | 1 | 4 | 3 | 18 | 26 |
| 12 | Harvest of 1949 | - | 1 | 3 | 17 | 21 |
| 13 | Harvest of 1950 | - | 3 | 3 | 10 | 16 |
| 14 | Harvest of 1951 | - | 3 | 3 | 10 | 16 |
| 15 | Pole at Ord Farm | - | 3 | 3 | 7 | 13 |
| 16 | Field of Station | - | 3 | 3 | 7 | 13 |
| 17 | Harvest of 1948 | - | 3 | 3 | 14 | 20 |
| 18 | Examination of Ord | - | 1 | 1 | 14 | 16 |
| 19 | Ordnance Farm at | | | | 25 | 34 |
| | Ord Farm | - | 5 | 3 | | |
| 20 | Harvest of 1949 | - | 3 | 3 | 7 | 13 |
| 21 | Examination of 1949 | - | 3 | 3 | 7 | 13 |
| 22 | Harvest of Ord | - | 3 | 3 | 7 | 13 |
| 23 | Harvest of 1950 | - | 3 | 3 | 7 | 13 |
| 24 | Ord at Ennor | - | 3 | 3 | 10 | 16 |
| 25 | Ennor at 1949 | - | 3 | 4 | 11 | 18 |
| 26 | Harvest of 1949 | - | 3 | 3 | 7 | 13 |
| 27 | Potatoes at 1949 | - | 3 | 3 | 14 | 20 |
| 28 | Examination at Ord | - | 3 | 3 | 7 | 13 |
| 29 | Ennor-in-at 1949 | - | 1 | 3 | 10 | 14 |
| 30 | Examination at Ord | - | 3 | 3 | 7 | 13 |
| 31 | Ennor-in-at 1949 | - | 3 | 3 | 7 | 13 |
| 32 | Harvest of 1950 | - | 3 | 3 | 7 | 13 |
| 33 | Ennor-in-at 1949 | - | 3 | 3 | 7 | 13 |
| 34 | Harvest of 1950 | - | 3 | 3 | 7 | 13 |
| 35 | Examination at | | | | | |
| | Oxbyke | - | 3 | 3 | 7 | 13 |
| 36 | Harvest of 1950 | - | 3 | 3 | 7 | 13 |
| 37 | Ennor-in-at 1949 | - | 3 | 3 | 7 | 13 |
| 38 | Harvest of Ord | - | 3 | 3 | 7 | 13 |
| 39 | Examination at | | | | | |
| | Oxbyke | - | 1 | 3 | 10 | 14 |
| 40 | Harvest of 1950 | - | 1 | 3 | 4 | 8 |

Records published in 1947 of Harvest Index Analyses from Commercial Varieties Grown Overseas.

## TRAFFIC ADMINISTRATION

### Existing Situation

The San Francisco traffic engineering program ranked eleventh among the fourteen cities over 500,000 population in the 1947 National Safety Contest. Three factors explaining San Francisco's poor record are that administration of traffic control and planning in San Francisco is divided among various departments, proper authority is lacking, and manpower devoted to this activity is inadequate. As a consequence, many traffic engineering functions are not being carried out as they should be.

Proper administration is the key to the traffic accident and congestion problem. Evidence of short-comings in this respect is found in the maze of conflicting movements at Market Street intersections. Improper signal control at many intersections as well as excessive use of stop signs at others attests further to the need for better traffic control methods. Most of these improper conditions are the result of piecemeal efforts to control traffic over the past years. Failure to coordinate traffic planning and to conduct an aggressive campaign against accidents and congestion has produced chaotic traffic conditions apparent to everyone.

A program is recommended which will assure continual study of traffic to uncover the locations and causes of improper traffic operations. It includes the maintaining of crews of men on the streets checking speeds, delays to traffic, and traffic volumes. Accident collision diagrams for hazardous streets and intersections would be kept up-to-date under such a program with engineers constantly observing the increase or decrease in accident frequency. These studies would lead to recommendations as to means of reducing the hazards. These are the types of traffic engineering functions that are lacking today but which should be routine activities in a city the size of San Francisco.

### Recommended Administrative Unit

The recommended Traffic Engineering Bureau and plan of organization is shown in chart form. This is modeled after the plan recommended by a joint committee of the American Association of State Highway Officials, the American Public Works Association and the Institute of Traffic Engineers and set forth in the publication entitled "Traffic Engineering Functions and Administration", published by Public Administration Service.

### Manpower

The Bureau of Traffic Engineering should be staffed with at least seventeen persons working full time on traffic engineering, exclusive of signal electricians, painters, secretarial help, and other non-engineering employees.

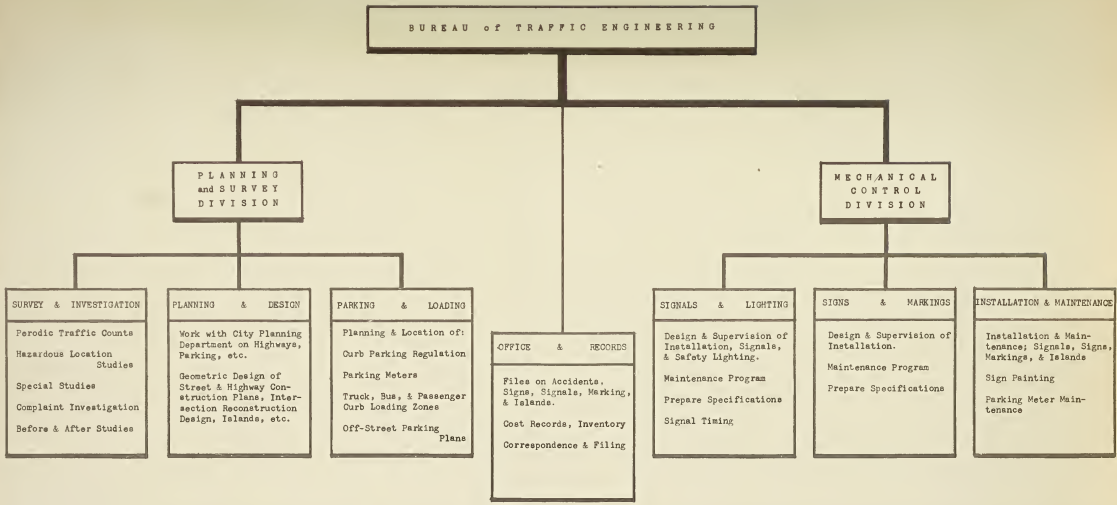
Suggested personnel for the Bureau of Traffic Engineering follows:

Traffic Engineer.
Secretary.
Counter Clerk and Telephone Receptionist.
Associate Traffic Engineer (Director of Planning and Survey Division).
Assistant Traffic Engineer (Survey, Investigation, Parking, Loading):
    Seven Field Traffic Checkers-Clerks.
    One Draftsman.
Assistant Traffic Engineer (Planning and Design):
    One Draftsman-Designer.
Associate Traffic Engineer (Director of Mechanical Control Division).
Assistant Traffic Engineer (Signals, Lighting, Signs and Markings):
    One Draftsman.
Assistant Traffic Engineer (Installation and Maintenance):
    Signal Electricians.
    Painters.
    Meter Repairmen.
    Installation and Maintenance Men.

Functions

Traffic engineering and control activities are now spread among five city departments - Public Works, Police, Planning, Electricity and Public Utilities. An example of the illogical situation which can develop under these conditions is the fact that the Department of Electricity determines signal timing for the Wiley-type traffic signals, while the Department of Public Works times the new 3-light signals. It is obvious that this activity, as well as many others relating to traffic, are all a part of the same problem and should be centered under one administrative unit.

Suggested resources for the Library of Service Coordination Offices

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V TRAFFIC CONTROL

20 PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

# PROPOSED TRAFFIC ENGINEERING BUREAU

## RECOMMENDED PLAN OF ORGANIZATION

The following table illustrates the duplication of effort and the dispersion of traffic engineering activities among the five city departments:

| Activity | Public Works | Police | Planning | Electricity | Public Utilities |
|---|---|---|---|---|---|
| Traffic Surveys and Investigations | X | X | | | X |
| Accident Maps and Analyses | X | X | | | |
| Through Streets Planning | X | X | X | | |
| Planning One-Way Streets | X | X | X | | |
| Street and Island Design | X | | | | |
| Traffic Signal Timing | X | | | X | |
| Installation of Signs and Signals | X | X | | X | |
| Installation of Paint Markings | X | X | | | X |
| Bus and Street Car Loading Zone Plans | X | X | | | X |
| Curb and Off-Street Parking Plans | X | X | X | | |
| Parking Meter Plans, Collections, etc. | X | X | | | |
| Establishment of Turning Prohibitions | | X | | | |

The following list of functions is recommended for the proposed Traffic Engineering Bureau:

1. Traffic Surveys and Investigations.
2. Traffic Planning and Design.
3. Studies and Plans for Curb Parking. and Loading Regulations.
4. Traffic Signal Location and Timing.
5. Traffic Signs and Markings.
6. Installation and Maintenance of Traffic Control Devices.
7. Office and Records.

| Activity | Public Access | Leases | Planning | Enforcement | Not in Program |
|---|---|---|---|---|---|
| [illegible] | X | X | | | X |
| [illegible] | | X | | | |
| [illegible] | X | X | X | | |
| [illegible] | X | X | X | | |
| [illegible] | X | | | | |
| [illegible] | X | | | X | |
| [illegible] | X | X | | X | |
| [illegible] | X | | | | X |
| [illegible] | X | X | | | X |
| [illegible] | | | X | | |
| [illegible] | X | X | | | |
| [illegible] | | | | | |

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]

## MISCELLANEOUS TRAFFIC CONTROL MEASURES

### Staggered Hours

San Francisco experiences two peak traffic flow periods each working day. The October 1947 cordon count of traffic entering and leaving the Metropolitan Traffic District showed that 20.6 per cent of the 12-hour passenger load entered during the morning peak hous, 7:30 to 8:30 A.M., and that 22.2 per cent left during the afternoon peak hour, 4:30 to 5:30 P.M. The afternoon peak hour traffic was 3.7 times as heavy as the average during the off-peak hours between 9:00 A.M. and 4:00 P.M.

This represents inefficient operation from all viewpoints. An obvious method of rectifying this situation is the staggering of office and store opening and closing hours. Most cities did this during the war as a transportation conservation measure. Some of them are considering it now as a relief measure for the rising tide of traffic volumes. New York recently accomplished a marked improvement in rush hour crowding on subway trains through a staggered hour program.

There are certain aspects of a staggered hours program which make it difficult to achieve. Closing hours must be altered at least 30, and preferably 45 minutes to be effective. Labor union contracts frequently stipulate hours of work, which may be difficult to change, especially when changes are not uniform.

In view of the general reluctance to agree on a staggered hour program, it is suggested that other measures, such as progressive signal systems, one-way streets and curb parking prohibitions be made effective before attempting to secure agreement on a staggered hours program in peace time.

### Angle Parking

Angle parking is like sludge in a public water main. It can slow the stream of traffic to a trickle and constrict it severely. Accident hazards are greatly increased by such parking when drivers back out from the angle stalls into the stream of traffic.

With parallel parking under normal conditions on a 54-foot street, four lanes are free for moving traffic. This assures a maximum capacity for the street of 1,400 vehicles per hour in each direction. Angle parking on the same street cuts the number of free lanes to two, and reduces the maximum carrying capacity to 700 vehicles per hour. In other words, angle parking on such a street cuts the capacity in half.

We recommended the adoption of a policy of abolition of angle parking in favor of parallel parking on all major thoroughfares and through streets. In addition, such parking should be eliminated on all thoroughfares on which public transit lines are operated.

### Merchandise Deliveries

Truck pickups and deliveries are necessary to the business life of the Central District. Much of this is done at the curb, however,

[illegible]

[illegible]

[illegible]

impeding pedestrian travel as well as contributing to street traffic congestion. This can be remedied to a great extent by strictly enforcing the ban against automobile parking in truck loading zones. There are many such yellow painted zones in the business district, totaling space enough for nearly 2,000 trucks at one time. However at present these spaces are frequently blocked by private automobiles. The parking survey showed more private automobiles than trucks occupying these zones, with an average parking duration of 57 minutes.

Generally speaking, the existing curb truck zones are adequate to take care of merchandise deliveries, provided the loading zones are kept free of private parking. Deliveries are prohibited during rush hours now on certain heavily traveled arteries. Growing traffic will probably force extensions of these restrictions.

A few cities have adopted zoning ordinances requiring the provision of off-street loading facilities for retail stores, wholesale houses and industrial buildings. Consideration of such requirements is suggested in San Francisco. The benefits to the public, to the truckers, to the commercial establishments and to the building owners have been proven very clearly in the Rockefeller Center development in New York City. The buildings in this area have fully contained facilities for merchandise deliveries and shipments and also for automobile parking.

Possible off-street loading requirements are being studied by the Department of City Planning for incorporation in the revised zoning ordinance now under preparation.

# CHAPTER VI

## THE PARKING PROGRAM

The provision of convenient and adequate terminal facilities for private automobiles is one of the pressing problems facing American cities today, and San Francisco is no exception. The economic welfare of the commercial interests depends upon solution of the parking problem. The present inadequacy in terminal capacity acts as a lid throttling the natural expansion of activities in the downtown district. The purpose of this parking study is to show the relation between parking capacity and demand, both existing and future. Then starting from these basic facts, the report sets forth recommendations for improving the situation.

Policy determination is of major importance at this time. These policy matters involve such highly controversial questions as enforcement, fringe vs. centralized parking, public or private financing, subsidized or self-supporting operation, and type of operation.

There is need for provision of additional off-street facilities convenient to the shopping and business district at the earliest possible moment. Notonly are garages needed to supply the existing unfilled demand, but they are needed to meet the anticipated increase in demand which will accompany the expansion in capacity of highways leading to the central business district. Parking lots in this district may become unavailable for parking as new buildings are constructed, which will generate additional demands for parking space at the same time that they displace existing parking capacity.

A broad concept of the needed parking expansion program is afforded by this report. It should aid in developing plans that will be neither grossly inadequate nor overly ambitious.

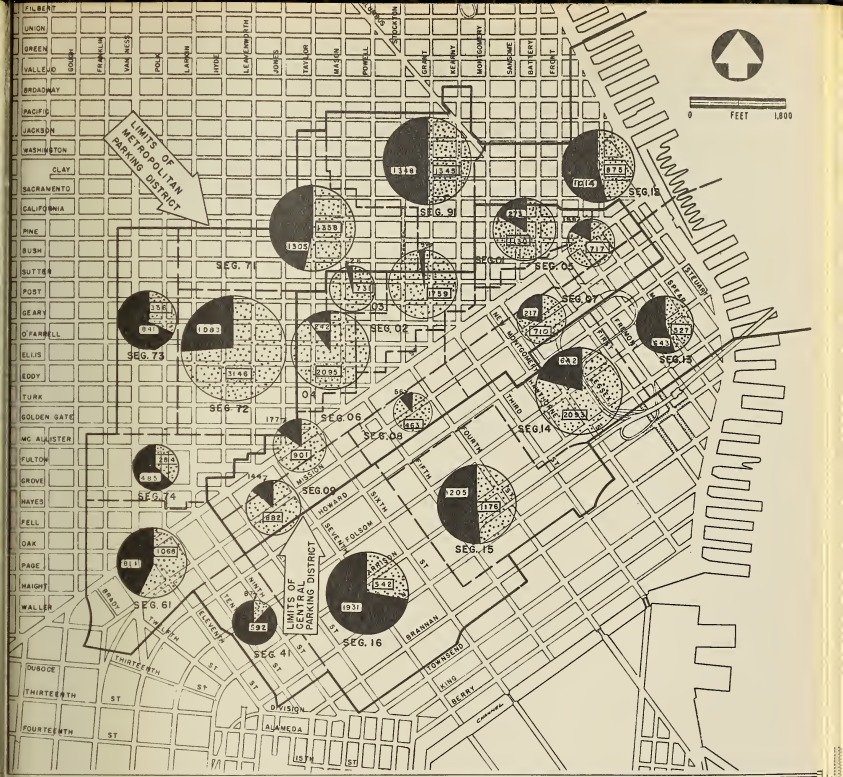
### Parking Survey Data

Fortunately much valuable data on ultimate destinations of parkers and others in San Francisco were made available as a result of the Bay Area Metropolitan Traffic Survey of origins and destinations conducted during 1946 and 1947 by the California State Division of Highways in cooperation with the City of San Francisco and the Public Roads Administration, Federal Works Agency. These data have provided an accurate base for determining the demand for parking as shown in this report.

Three aspects of parking were investigated - the supply of parking spaces, the usage of these spaces and the destinations of drivers after parking their vehicles.

The district included in the survey is shown in the accompanying Plates and is called the Metropolitan Parking District. It is somewhat smaller but coincides very nearly with the Metropolitan Traffic District. It is the area within which all of the parking is done by persons bound for the Central Business District. The inner core of this district is termed the Central Parking District and coincides with segments 01 to 09 inclusive (see Plate VI-1).

The inventory of curb space (see Table I) was obtained in the field and includes the number of car stalls by every classification of

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OCTOBER 1948

# EXISTING PARKING FACILITIES

## TOTALLED BY SEGMENTS METROPOLITAN PARKING DISTRICT 1948

PARKING STALLS IN GARAGES AND LOTS.....22,245

PARKING STALLS AT CURBS (LOADING ZONES AND PROHIBITED ZONES NOT INCLUDED).....13,253

TOTAL.....35,498

NOTE: TOTAL VOLUME PROPORTIONAL TO AREA OF CIRCLE

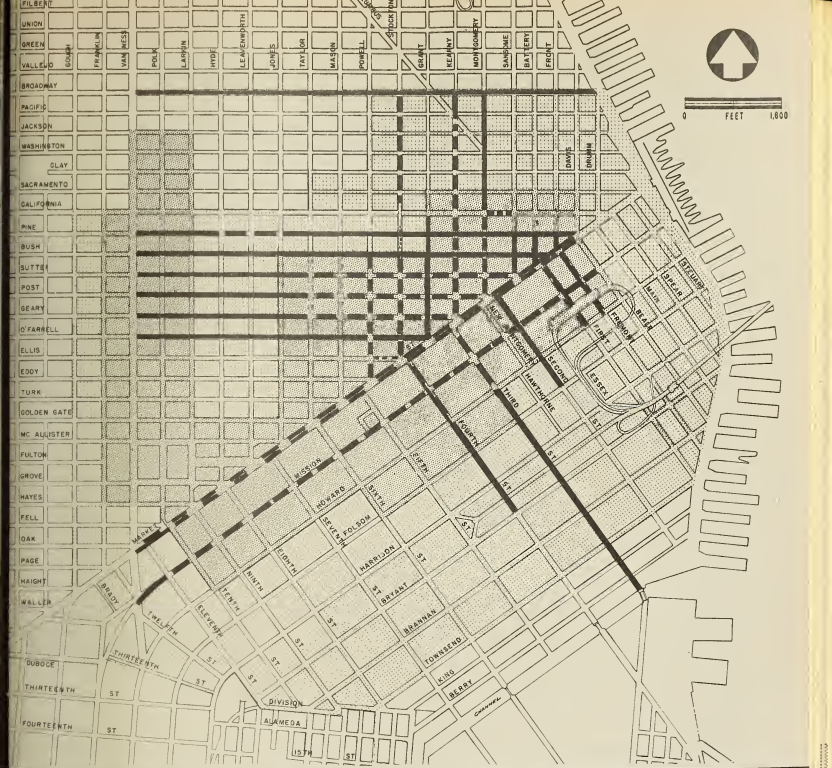
PARKING

VI

1

PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

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# RECOMMENDED NO-PARKING STREETS

## AND CURB-PARKING TIME LIMIT ZONES METROPOLITAN TRAFFIC DISTRICT-1970

PARKING VI

PROHIBITED PARKING 7A.M.-6P.M. (PARKING NOW PERMITTED)

PROHIBITED PARKING 7A.M.-6P.M. (PARKING NOW PROHIBITED)

ONE-HOUR ZONE

TWO-HOUR ZONE

2 PLATE

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# PARKING TURNOVER

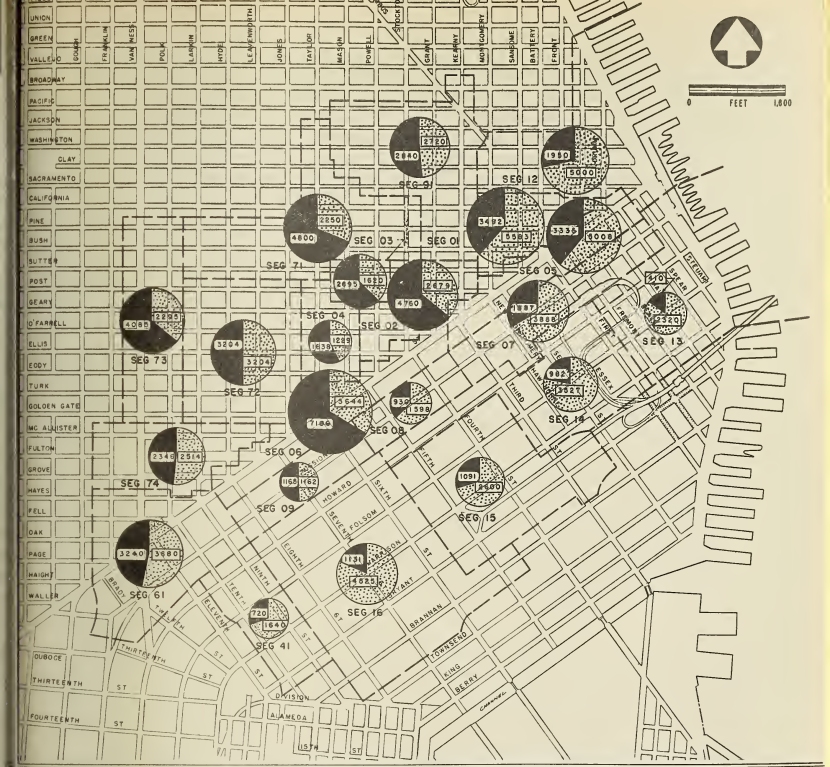
## TOTALLED BY SEGMENTS - METROPOLITAN PARKING DISTRICT
## 7A.M. TO 7P.M. - NORMAL WEEKDAY - 1948

PARKING
VI
3
PLATE

TOTAL CARS PARKED IN GARAGES AND LOTS..... 28,600
TOTAL CARS PARKED AT CURBS..... 71,400
TOTAL..... 100,000

NOTE TOTAL VOLUME PROPORTIONAL TO AREA OF CIRCLE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING


UNION
GREEN
VALLEJO
BROADWAY
PACIFIC
JACKSON
WASHINGTON
CLAY
SACRAMENTO
CALIFORNIA
PINE
BUSH
SUTTER
POST
GEARY
O'FARRELL
ELLIS
EDDY
TURK
GOLDEN GATE
MC ALLISTER
FULTON
GROVE
HAYES
FELL
OAK
PAGE
HAIGHT
WALLER
DUBOCE
THIRTEENTH
FOURTEENTH
GOUGH
FRANKLIN
VAN NESS
POLK
LARKIN
HYDE
LEAVENWORTH
JONES
TAYLOR
MASON
POWELL
STOCKTON
GRANT
KEARNY
MONTGOMERY
SANSOME
BATTERY
FRONT
0 FEET 1,000
SEG 01
SEG 02
SEG 03
SEG 04
SEG 05
SEG 06
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2840
2120
1980
5900
4800
2250
3492
5583
3335
1008
2693
1650
2679
4760
4003
2295
1638
1249
3804
3224
3544
7184
930
598
1882
3884
2346
2514
1150
1162
1091
1400
3240
3680
1831
4085
720
1640
370
330
ARGUELLO
LEAVENWORTH
HYDE
LARKIN
POLK
VAN NESS
FRANKLIN
GOUGH
FILLMORE
STEINER
PIERCE
SCOTT
DIVISION
BRODERICK
DAVIS
SANSOME
BATTERY
FRONT
LEIDESDORFF
MONTGOMERY
KEARNY
GRANT
STOCKTON
POWELL
MASON
TAYLOR
JONES

## Curb Turnover

Table II shows the present usage of curb parking space. The usage in San Francisco has been compared with that in other cities and found to be but half that in other cities where parking regulations are enforced. Total vehicles parking at curbs on a normal weekday are estimated at 71,400, with 22,330 of these, or approximately one-third, parking in illegal zones. This is a high incidence of parking in unauthorized zones. In time-limited zones the turnover was found to be relatively low compared with the maximum practical turnover. The need for more stringent enforcement of parking regulations is clearly indicated. The low turnover in the 40-minute zones, for instance, is due in large part to the excessive durations of parking. Although curbs are almost always filled to near 100 per cent of capacity, usage could be doubled through stringent enforcement of time limits and consequent increase in turnover at each curb stall.

## Curb Parking Durations

Table III shows observed durations of parking. It is significant to note the number of overtime parkers in time-limit zones. For instance in the 40-minute zones, 54 per cent of the autos were parked overtime, and in the 60-minute zones - 46 per cent.

It is seen that truck and taxi loading zones are being illegally used by private cars, thus forcing trucks to double park (note in Table III the high incidence of double parking by trucks). The average length of stay of illegally parked autos in these zones was 57 minutes, indicating that much of the impediment to traffic flow by double parked trucks is due to private cars blocking loading zones. Average stay of autos in no parking zones was 69 minutes.

## Off-Street Parking Facility Usage

Table IV shows the total number of cars parking between 7:00 A.M. and 7:00 P.M. in lots and garages in the Metropolitan Parking District, as reported by the parking facility operators (spot checked in the field by our observers). The data were secured last December and January and in some cases may represent a higher than normal turnover rate. However, this turnover information is used merely to illustrate how near to capacity the off-street facilities are now operating. The maximum practical total turnover figure, based upon maximum rates observed in local lots and garages is used in the calculations as to difference between actual demand (as represented by auto driver destinations) and maximum capacity available.

It is evident that off-street parking facilities were operating at 56 per cent capacity at the time of the survey.

## All-Day Parkers

The all-day storage of automobiles in a congested area such as the Metropolitan Parking District is an expensive use of public streets. Each such dead storage vehicle blocks one space for the day, thus preventing six other vehicles from being parked in that space. Generally it is the employer or his employee who is the all-day parker, but these are the ones whose complaints are frequently heard about the need for more parking space for the shopper.

According to the curb turnover study, almost 9,000 automobiles park for six hours or more at the curbs in the Metropolitan Parking District. These are parked in locations shown in Table V.

Enforcement of existing time limits to prevent this all-day parking would produce a six-fold increase in turnover at the curb space now preempted by all-day parkers. The 5,000 curb spaces thus released in legal zones would accommodate 30,000 shoppers, at the current turnover rate of six cars per space per day in 40-minute zones. This is evidence of the immediate parking relief that could be afforded through a rigid enforcement of parking regulations. Enforcement directed at correction of overtime parking, particularly all-day parkers, in the Metropolitan Parking District is clearly indicated. The extra curb capacity made available by proper enforcement is credited in calculating the need for extra off-street parking stalls described later in this report.

Off-street facilities too suffer from the sluggish turnover caused by the all-day parker. Here there will always be a certain small amount of long-time storage, but much can be done to discourage this inefficient type of parking through setting proper parking rates.

The following example shows the high incidence of all-day parking in off-street facilities. This shows the parking durations in a garage located in the high-demand area. Note that all-day parkers (over 6 hours) constituted only a third of the total parkers, yet used 60 per cent of the parking capacity, in terms of space hours. The 85 automobiles parked under two hours constituting one-third of the total, used only 9 per cent of the available space hours.

| Parking Duration | Observed Number of Cars | Space Hours Used | Per Cent of Total |
|---|---|---|---|
| 0 to 1 hour | 31 | 16 | 2 |
| 1 to 2 hours | 54 | 81 | 7 |
| 2 to 3 hours | 32 | 80 | 7 |
| 3 to 6 hours | 57 | 255 | 23 |
| Over 6 hours | 83 | 695 | 61 |
| Total | 257 | 1,127 | 100 |

Recommendations on Curb Parking

Approximately one-third of the total legal parking stalls are unlimited. It is recommended that these zones should be restricted to certain time limits as shown on Plate VI-2 to insure best use of curb space. A good part of these are situated in alleys which are wide and used as streets. Many autos are habitually stored for long periods of time at these locations, thus limiting the parking capacity.

It is our judgment that increased traffic volumes will eventually require the prohibition of curb parking between 7:00 A.M. and 6:00 P.M., within the limits shown on Plate VI-2. These thoroughfares will function as major feeders to the proposed freeway system, and as such should be kept free of all impediments to traffic flow. At present, some of these streets have no-parking restrictions during the peak flow

period of the day. Eventually they should be closed to parking for the entire business day.

Plate VI-2 shows zones recommended ultimately for specified maximum time limits. There will be sections of block face within these zones where it may be necessary to restrict parking further, either to shorter limits or to provide loading zones or space for bus stops. The pattern shown in Plate IV-2 is designed to show the ceilings in curb parking limits. In general this allows no more than one-hour parking within about two blocks of major driver destination points and two-hour maximum parking beyond this within the Metropolitan Traffic District. The existing city ordinances specify one-hour maximum parking limit anywhere within the Metropolitan Traffic District. It is believed that one hour is too short for areas considerably removed from high demand areas, and that a two-hour ceiling is more practical and easier of enforcement. Parkers who are willing or have to walk longer distances should be allowed a longer parking period.

Parking Habits Need to be Changed

The increasing need for parking space in the business district requires that existing inefficient parking practices should be altered. To accomplish this the following objectives should be sought:

All-day parkers employed in the business district should be encouraged to leave their vehicles at home and use public transit facilities,

All-day parkers who require the use of their vehicles during the day should park in parking lots or garages outside of the Central Parking District,

Curb parking over two hours should be eliminated, and

Overtime and illegal parking should be stopped

The accomplishment of these objectives would increase the capacity for turnover at the curb and in off-street facilities. This would allow many more short-time parkers (shoppers and people on business errands) to park in the Metropolitan Parking District than at present.

It is recognized that allowances should be made for a certain amount of all-day storage of private vehicles. However, this should be confined largely to parking facilities located outside the most congested core area with a minimum of all-day storage within the core area.

These conditions are assumed in later calculations of demand for parking facilities.

Table VI shows the relation of existing turnover to maximum practical turnover in lots and garages located in segments of maximum parking demand. Note that Segments 02, 03 and 12 shows the highest turnover with off-street facilities operating at 86 per cent or more of maximum capacity.

The fact that present turnover is less than maximum practical turnover within many segments is explained as follows:

Actually most lots and garages are filled to capacity by 10:00 A.M. in Segments 01 to 12 - many stalls being occupied by all-day parkers. Maximum practical turnover is calculated on the basis of relatively fewer long-time parkers, or the accommodation of a greater number of cars of short-time parkers during the day. Many garages now are unable to take more cars, yet the average turnover is only 1.0 (one car per stall per day).

The calculations of demand are based on the assumption that existing lots and garages in the most congested core area would be operating at maximum efficiency with fewer all-day parkers and with higher turnover figures than at present.

Parking Rates

Present parking rates in local garages and lots encourage all-day parkers. In some instances it is no more expensive to park for eight hours than for one hour. In others it is only a little more expensive to stay all day.

As shown in Table VII, the average charge for parking two hours is 50 cents in garages and 38 cents in lots, while for eight hours, the average charges are 68 cents and 56 cents respectively.

An effort should be made to establish schedules of fees designed to encourage short-time parking. The all-day parker should be made to pay considerably more than the one or two-hour parker.

## DEMAND

The total demand for parking can be measured by the number of automobile driver destinations. Whereas the actual turnover of parking in any given area may be known, the total demand for parking in that area is not known unless we know how many persons wanted to park their automobiles in the area in question. The demand for parking or ultimate driver destinations exceeds the parking capacity in certain downtown areas.

Table VIII shows the ultimate destinations of persons, by segments, for the 12-hour period, 7:00 A.M. and 7:00 P.M. during a normal weekday as determined by the Bay Area Metropolitan Traffic Survey. The automobile driver destinations represent automobiles that would have been parked within the segment noted, providing the driver could find parking space.

A total of 116,573 automobile drivers reported trip destinations in the Metropolitan Parking District on a typical weekday in 1946-47. Of these, 62,686 or almost half were workers. Workers are defined as persons employed in the area.

The September 1948 check of 12-hour curb and off-street parking turnover showed that 100,000 vehicles were parked in the Metropolitan Parking District on a typical weekday. It may be presumed that the difference of 16,573 between driver destinations and parked vehicles represents vehicles parked outside the area and in small

spaces holding less than 10 cars each.

It may be seen that Segments 05 and 06, comprising the area bordering Market Street between Spear and Eighth Streets, are the districts of highest parking demand. Segments 01 and 02 covering the Financial and Shopping districts, are second in point of parking demand.

Analysis of Supply and Demand

Table IX indicates how the demand for parking compares with the supply of parking in each segment of the Metropolitan Parking District. The number of driver destinations determines 1948 auto demand. Possible maximum turnover is that determined (see Tables II and IV) as the maximum practical capacity of present facilities (using maximum practical turnover ratios shown in Table IV). The 1970 maximum practical turnover is based on a reduced curb inventory adjusted to take care of future needed curb parking restrictions.

Parking demand in 1970 is estimated at 20 per cent in excess of present demand based upon the estimated increase in Central Business District traffic to 1970.

Note that Segments 01, 02, 03, 05, 06, 07 and 08 show an excess of demand over capacity. This means that automobiles are parking outside of these segments and the occupants are walking to their destinations within the segments.

Segments 05 and 06 show the greatest shortage of parking spaces. The reason that the existing total turnover in these segments is not at a saturation level is due to the fact that the westerly end of 06 and the easterly end of 05 contain off-street facilities with lower turnover than those in the extremely high-demand areas in the remainder of these segments. This fact should be kept in mind in selecting suitable sites for proposed new off-street facilities to serve 05 and 06. These should be located as near the junction point of these two segments (between Third and Fourth Streets) as possible.

Additional car stalls as shown in Table IX are required to meet the present parking shortages. The 1970 requirements are also shown. This analysis assumes full compliance with parking regulations and that the further curb restrictions as shown on Figure 2 will have been instituted by the year 1970.

It should be noted that these estimates are based on the present percentage use of private automobiles and public transit. It is contemplated, however, that the provision of convenient rapid transit facilities in the future will fully offset the attractiveness of the contemplated freeways.

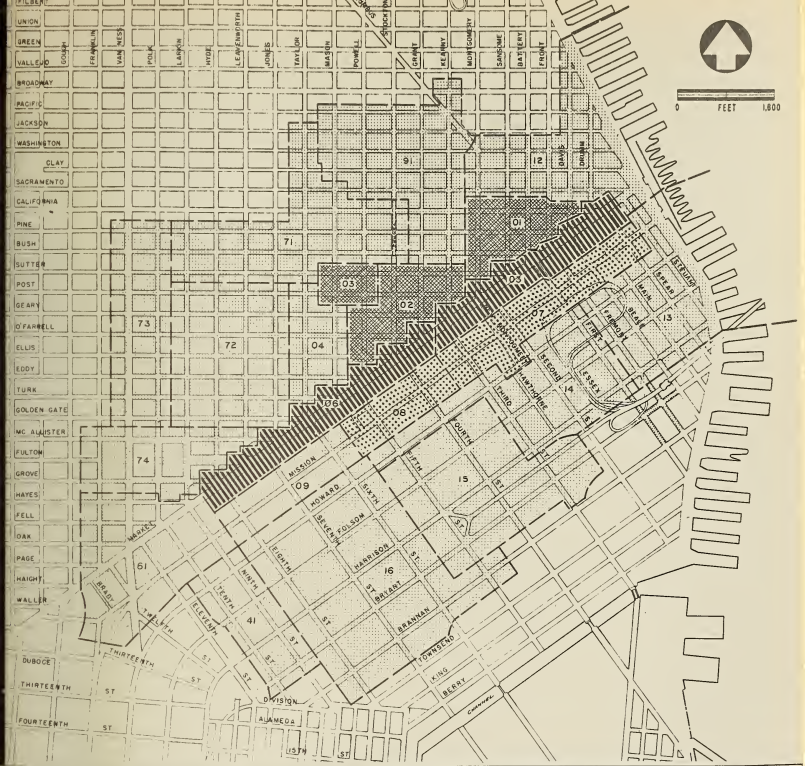
Additional Parking Capacity Needed

The greatest shortage of parking capacity exists in Segments 01 to 09 inclusive, comprising the Central Parking District.

To provide parking space for every auto driver now destined to this area, 5,740 off-street car stalls are needed now, and the need

by the year 1970 is estimated at 14,000 stalls. Most of these should be located within the segments to be most convenient to driver destinations.

The importance of locating these additional facilities within 1,000 feet of the centers of demand cannot be overstressed. In Portland, Oregon, a survey revealed that 70 per cent of off-street parkers and 90 per cent of curb parkers store their cars less than 1,000 feet from their destinations. To be attractive and effective, off-street facilities should be located within this limit.

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# EXISTING SHORTAGES OF PARKING SPACES

## BASED UPON RELATION OF EXISTING SUPPLY AND DEMAND METROPOLITAN PARKING DISTRICT 1948

NUMBER OF ADDITIONAL PARKING STALLS NEEDED TO OVERCOME PRESENT SHORTAGE IN EACH SEGMENT

NONE

0 – 1000

1000 – 2000

2000 – 3000

PARKING VI

5

PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

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OCTOBER 1948

# DENSITY OF DESTINATIONS OF AUTO DRIVERS IN THE METROPOLITAN PARKING DISTRICT 1946 - 1947

DESTINATIONS PER 1,000 SQUARE FEET OF LAND

- 100 & UP
- 99 - 80
- 79 60
- 59 - 40
- 39 - 20
- 19 - 0

PARKING

VI

6

PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

## ECONOMICS OF OFF-STREET PARKING FACILITIES

An economic study has been made to determine the unit costs of off-street parking facilities of various types in the downtown area. For the purpose of this study, parking costs were analyzed on a hypothetical area 100' x 200' considering it as a parking lot, a two-level open deck parking structure, a three-level structure and a four-level structure, and assuming the site (land and improvements) could be obtained at $0.00, $5.00, $10.00, $15.00, and $20.00 per square foot. These land costs are representative of actual value of property in the area between Howard and Market Streets, as well as several sites north of Market Street, properties which might be economically used as parking garage sites. Cost estimates were also made for a three-level underground garage.

### Assumptions

The following assumptions were made in the calculations for parking lots:

That 200 square feet of area per car would be needed;

That the surface would be graded and paved;

That landscaping would be included with a hedge or attractive fence on the borders;

That stalls would be marked and separated by posts between rows; and

That the area would be lighted for night parking use.

Parking garage estimates were based on the construction of a simple concrete open deck structure with ramps connecting different floors. Suitable allowances were made for ramps, columns and office space. A small office, waiting room for customers, and two rest rooms were included. Cost estimates were compared with and without basements, but in every case the cost of the basement was found not justifiable. Therefore, the cost estimates of above-ground facilities do not include basements.

### Costs

Both fixed charges and operating costs were included in the estimates. Fixed charges were computed on the basis of retiring bonds in twenty years at four per cent interest. Other fixed charges included taxes, computed on the 1948 rate of $60.90 per $1,000 of assessed value, and upkeep and repairs which were computed on the basis of one per cent of the new structure cost per year, and for parking lots, fiver per cent of the improvement cost.

Estimates of operating costs included:

Management
Attendants
Cashiers and Clerks
Social Security Tax
Workmen's Compensation Insurance
Fire Insurance
Personal and Property Liability Insurance
Light and Power
Heating
Advertising, and
Telephone

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Parking in most downtown lots and garages now costs the driver between 50 and 75 cents per parking (average fee for two-hour parking is 50 cents in garages and 38 cents in lots). Therefore, the preceding table indicates that all costs properly chargeable to parking facilities can be supported by parking rates approximating those now paid, provided land cost is $20.00 or less per square foot.

In other words, by charging 50 cents per car for two-hour parking, in a new garage built on property costing $20.00 per square foot, the entire cost of providing the garage parking would be met by parking fees. This does not take into account additional revenues that could be obtained through leasing out part of the garage for retail store area, or offering motor vehicle maintenance and fuel services. With these added revenues, the parking fees would more than carry the cost of providing the facility.

The preceding analysis indicates that parking garages are the most economical type of off-street facility.

This analysis also indicates that most existing parking lots represent interim use of land too valuable for the function they now serve. They are able to exist either because:

They render sub-standard service, or

Owners of the land are willing to rent for a fee that will cover taxes, without much or any return on invested capital, or

Other services such as washing, greasing and gasoline sales are combined with the parking of cars to compensate for loss incurred by parking operation, or

They are located so as to attract a substantial volume of evening or all-night parking.

Types of Parking Facilities

One solution often advocated is the provision of parking lots at outlying points on the fringe of the central traffic area with public transit service shuttling between the lots and the downtown area. Such joint parking lot transit operation has two advantages:

1. It relieves traffic and parking congestion on the downtown streets, and

2. Reduces the cost of the parking facility since land is generally cheaper farther away from the business district.

Despite these potential advantages, there is no known instance of such facilities having been installed and operated on a self-supporting basis. Fringe parking lots and supplemental public transit service are currently operated in Chicago and Toronto only through substantial subsidies. Combination transit parking facilities have been tried in recent years in Denver, Detroit, Grand Rapids, Pitts-

burgh and Atlanta, and discontinued because of poor patronage.

There is no present indication that San Francisco would be an exception in this matter; therefore, it is not recommended that such an experiment be undertaken at this time.

There is one type of transit parking plan that has been proven successful in a number of places - a parking lot at a suburban or outer terminal of a public transit route providing good express service. This plan has a limited application in San Francisco. Such a parking lot is contemplated at the outer end of both the Mission and Market Street rapid transit routes which will offer fast transit service to the central business and shopping districts.

The opening of San Francisco's Union Square Garage in 1942 and its subsequent financial success has attracted nationwide attention. Many proposals have been made in other cities to follow San Francisco's example and relieve the shortage of parking stalls by underground storage. Union Square is a four-story parking structure wholly underground and in the very heart of the shopping district. Its capacity is 1,500 cars and daily turnover between 7:00 A.M. and 7:00 P.M. is about 3,000 vehicles.

The only other underground parking garage of any size, available to the general public, is the Avenida Nueve de Julio Garage in Buenos Aires, built at government expense under the principal boulevard in thedowntown area and operated by the Argentine Automobile Club.

The foregoing economic studies show that private property can be acquired and above-ground parking garages built at a lower capital outlay than through the conversion of nearby available public areas to underground garages. It is concluded, therefore, that the building of additional underground garages in San Francisco is not warranted under the economic conditions now prevailing in downtown San Francisco.

RECOMMENDED PARKING PROGRAM

The foregoing analysis of parking supply and demand shows that additional off-street parking capacity is especially needed today in the Central Parking District. It is recommended that multi-level parking garages be constructed within the areas shown on Plate VI-8 in order to supply the needed expansion in capacity. Garages are recommended because they are the most economical means of providing the needed parking supply.

Estimated costs were based on four-level and five-level parking garages entirely devoted to automobile storage. Actually it may be desirable and feasible to incorporate ground level retail store area to increase revenues and to permit unbroken business frontages at the sidewalk level.

Plate VI-8 shows the areas of parking shortage. Also shown are the areas in which it is recommended that sites be chosen for parking garages. These areas lie within 1,000 feet of the principal parking shortage areas and afford sites with low property values.

The following tabulation indicates the recommended total capacity of proposed parking facilities to serve the shortage areas shown in Plate VI-5. Two figures are given - one to meet present needs, the second to meet the estimated 1970 requirements. This figure would be increased in the event that existing parking lots or garages are converted to other uses prior to the year 1970.

FACILITIES

| Location (See Plate VI-8) | To Serve Primarily Segments | Number of Car Stalls Needed 1948 | 1970 |
|---|---|---|---|
| Area A | 01 and 05 | 1,000 | 2,400 |
| Area B | 01 and 02 | 1,400 | 3,300 |
| Area C | 01 and 05 | 1,400 | 3,300 |
| Area D | 06, 07, 08 and 09 | 2,000 | 4,000 |
| Area E | 02, 03 and 06 | - | 1,000 |
| | | 5,800 | 14,000 |

Exact location of the structures within the recommended area should be determined by relative cost and ease of acquisition of the property. It should be noted that the number of additional spaces needed is meant to be a net gain. That is, should parking garages be built on the sites of existing parking lots, the spaces eliminated by the improvement must be replaced as a part of the total program.

Cost of Recommended Program

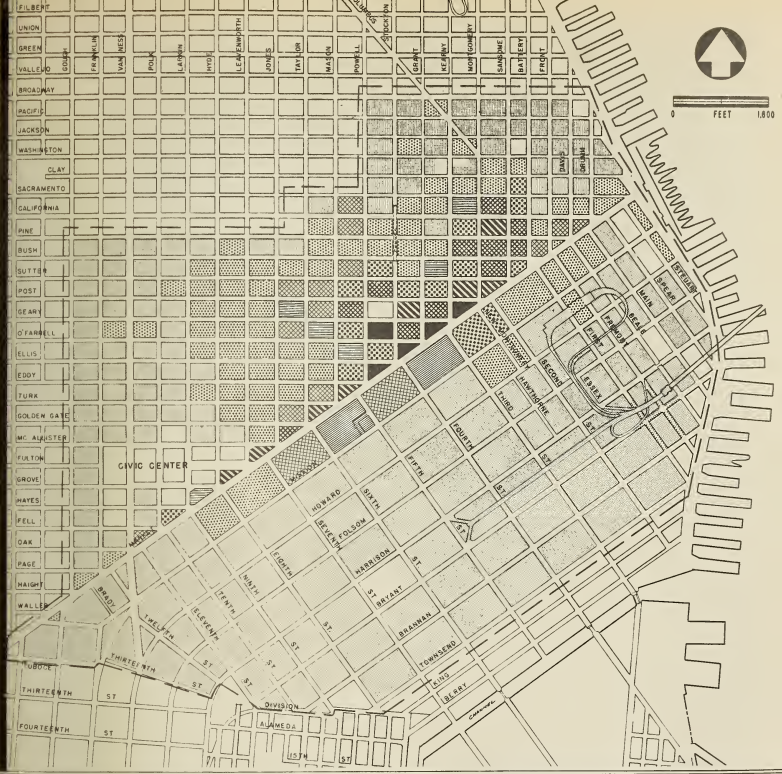
The approximate cost at 1948 prices of providing the needed total of 5,800 additional off-street spaces in off-street four-level and five-level parking garages is estimated at $8,000,000. These are the facilities needed today. The program needed by 1970 of 14,000 additional spaces is estimated at $20,000,000. These estimates are summarized in the following tabulation:

SUMMARY OF ESTIMATED COSTS OF PARKING PROGRAM

| Location (See Plate VI-8) | Additional Car Stalls Needed Now | 1970 | Estimated Costs Immediate Program Property | Structure | Total | 1970 Total |
|---|---|---|---|---|---|---|
| Area A | 1,000 | 2,400 | $ 550,000 | $ 650,000 | $1,200,000 | $ 3,000,000 |
| Area B | 1,400 | 3,300 | 1,200,000 | 900,000 | 2,100,000 | 5,000,000 |
| Area C | 1,400 | 3,300 | 1,200,000 | 900,000 | 2,100,000 | 5,000,000 |
| Area D | 2,000 | 4,000 | 1,300,000 | 1,300,000 | 2,600,000 | 5,500,000 |
| Area E | - | 1,000 | - | - | - | 1,500,000 |
| Total | 5,800 | 14,000 | $4,250,000 | $3,750,000 | $8,000,000 | $20,000,000 |

A comparison of the relative costs of carrying out this program with various types of facilities, showing effects of property values, will be found in Table X.

The cost of providing the needed facilities can be amortized over a 20-year period, utilizing the revenues derived from the parking fees comparable with fees currently charged. Provision for retail stores at the sidewalk level, desirable both from the standpoint of revenue and land use, will produce additional revenues.

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# ASSESSED VALUATIONS

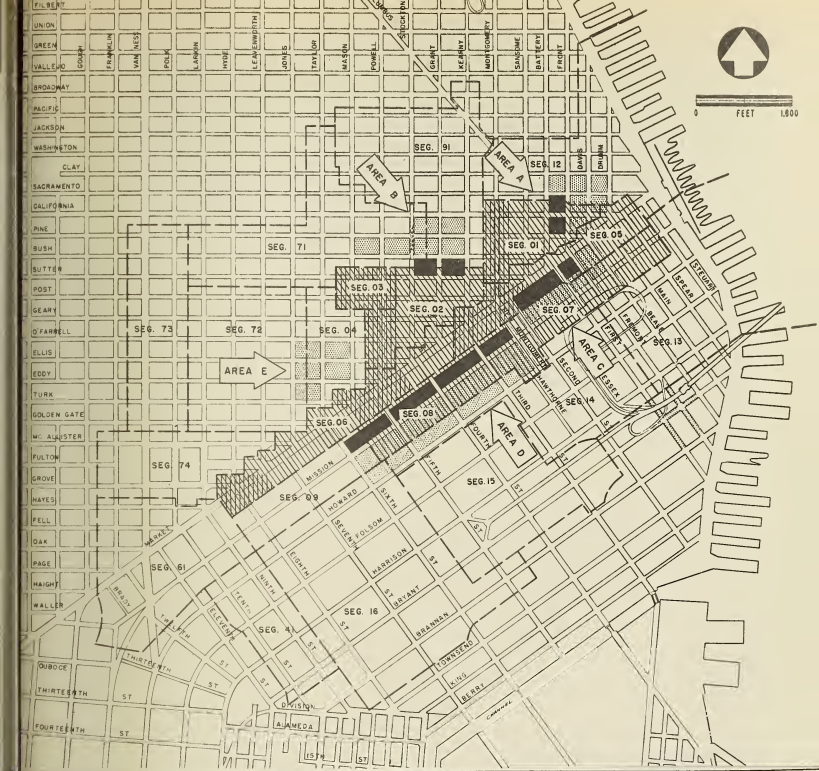
## LAND AND IMPROVEMENTS IN METROPOLITAN TRAFFIC DISTRICT

PARKING VI

PER SQUARE FOOT VALUATIONS

- $4.99 AND UNDER
- 5.00 – 9.99
- 10.00 – 14.99
- 15.00 – 19.99
- 20.00 – 29.99
- $30.00 – 39.99
- 40.00 – 49.99
- 50.00 AND OVER
- VALUATIONS NOT OBTAINABLE

7 PLATE

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# AREAS RECOMMENDED FOR PARKING GARAGES

## AND AREAS OF PARKING SUPPLY SHORTAGE METROPOLITAN PARKING DISTRICT 1948 – 1970

- AREAS RECOMMENDED FOR IMMEDIATE PROVISION OF GARAGES
- AREAS RECOMMENDED FOR FUTURE PROVISION OF GARAGES
- AREAS OF PARKING SHORTAGE
- AREAS OF MAXIMUM PARKING SHORTAGE (MAXIMUM CONCENTRATION OF AUTO DRIVER DESTINATIONS)

PARKING VI

8 PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

## Policy on New Facilities

The development of the freeways starting with the Bayshore Freeway now under construction, will accent the need for more terminal facilities and for more efficient use of all parking lots and garages. The rates established for these facilities should encourage short time parkers. The exact fees to be charged at new garages should be set to conform with those generally charged by existing garages in the same area. The new garages should be entirely self-supporting, and should offer no unfair competition to existing garages operated by private interests.

## Parking Meter Revenues

Parking meter revenues should not be used to subsidize off-street parking. The proposed garages can and should be self-supporting. However, local parking meter revenues properly may be pledged to secure revenue bonds issued to finance the proposed parking facil ties. Any surplus in meter revenues should be allotted specifically to traffic improvements, such as more police manpower, more traffic engineering department manpower and additional traffic control equipment such as signal signs and markings. In many cities, the ordinance authorizing the meter installation provides that the revenues shall be used for improvement of traffic conditions.

## Agency to Carry Out Program

In order to carry out the proposed parking program, it will be necessary for either an existing or new agency to handle financing, construction, and regulation of the new facilities. It will be desirable at the same time for this agency to exert certain controls over established parking facilities owned and operated privately.

The recommended parking program can be carried out by the City, the authority in this case being exerted through a city department. State Legislation (D.A. 5131a) permits cities and counties to do this; authorizing acquisition of land, construction of garages thereon and subsequent operation by the City or lease to private operators.

On the other hand, a special parking authority could be set up, providing proper permissive State legislation be enacted. Such an authority would have no advantage over a city agency, and furthermore, the City is empowered to proceed at once to acquire land for the proposed parking program. Therefore it is recommended that the City establish a parking agency as a separate department or under one of its existing departments, and proceed to assemble the needed properties, using the $5,000,000 bond issue fund now available for the parking program.

It should be pointed out that the existing State legislation is silent in respect to the use of the assembled lands for purposes other than parking, or for the financing of the facilities through revenue bonds. In view of the desirability of leasing a portion of the proposed garages for retail stores or other purposes, and of financing through revenue bonds, it is recommended that steps be taken to broaden the provisions of a D.A. 5131a accordingly.

It is recommended that the parking agency confine its activities to financing and control of off-street facilities, leaving parking planning work and all aspects of curb parking regulation to the city traffic engineering bureau.

The needed facilities can be provided on a self-supporting basis. No subsidy is necessary and none is advisable. No abatement of taxes is needed or recommended. It is important to maintain existing private garages. We recommend, therefore, that all facilities be financed by the issuance of revenue bonds, the principal and interest payments to be made solely from revenues from the leasing of revenue producing parking facilities. Such bonds will be marketable, in our opinion, if supported by pledging revenues from parking meters.

# APPENDIX A

## PROPOSED TRAFFIC ENGINEERING IMPROVEMENTS AT

MARKET AND SIXTH STREETS

HOWARD AND THIRD STREETS

MARKET STREET AND VAN NESS AVENUE

MARKET AND THIRD STREETS

HOWARD AND SIXTH STREETS

MARKET, GOUGH AND HAIGHT STREETS

APPENDIX A

## MARKET AND SIXTH STREETS

This intersection was the most hazardous of all in the year 1947. A total of 43 collisions was reported, 21 of which resulted in personal injury.

It is notable that in a survey made 10 years ago this junction was found to be the fourth most hazardous intersection (1938 traffic survey). During 1936, fourteen pedestrian injury and four other injury accidents occurred in addition to numerous property damage accidents, a record very similar to that for 1947. Traffic conditions have remained the same here for many years.

Study of accident facts here reveals no outstanding single cause or characteristic. There are a multiplicity of accident types, and occurrence of collisions is spread over the 24 hours. Traffic volumes are not appreciably higher here than at other Market Street intersections.

The basic reason for the high accident frequency at this five-point junction is that possible traffic movements and conflicts are many in number. The worst conflict of all is that between southbound Taylor Street traffic and northbound traffic from Sixth Street traveling into Golden Gate Avenue. Volume studies show these two movements to be heavy, particularly in the peak flow periods, further accentuating the friction and delay.

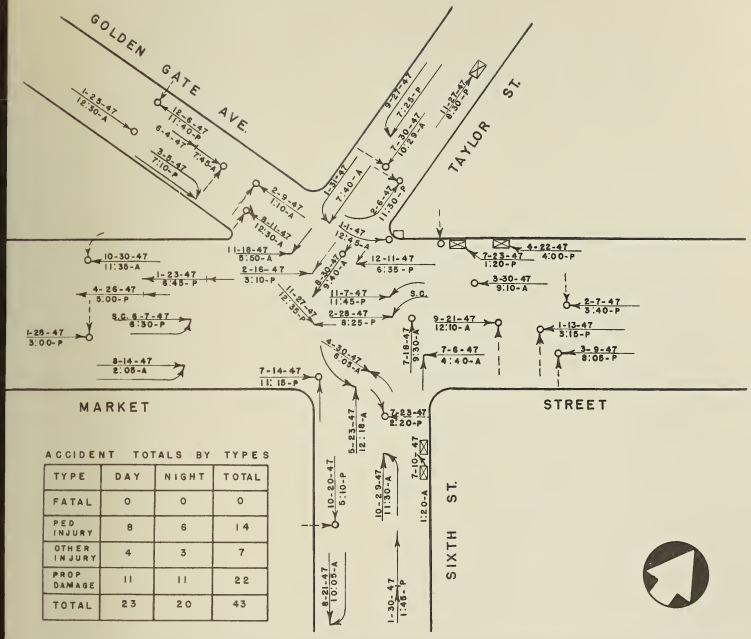
It is proposed, under the one-way street plan outlined in this report, to make Golden Gate Avenue one-way eastbound and Taylor Street one-way northbound. This will eliminate the two principal conflict points and will, it is believed, reduce accident frequency. Plate V-4 shows the proposed redesign here, involving in addition to the one-way streets, installation of a channelizing island and redesign of the curb return. Pedestrians will be particularly benefited by the elimination of entering traffic from Taylor Street, by the channelizing island (keeping traffic into well defined paths), and by the shorter distance between curbs.

Installation of new modern traffic control signals here, as recommended, will aid in reducing accident frequency, by providing stronger and clearer indications to drivers and pedestrians and by the benefits of reduced delays due to progressive timing.

## HOWARD AND THIRD STREETS

This is a regular right-angle signalized intersection south of the shopping and financial districts in what is commonly known as the "skidrow" district. Third Street carries heavy traffic, as it is one of the major north-south routes leading to the business and financial districts. Howard Street carries a heavy load of mixed traffic. Pedestrian traffic here is fairly heavy too. There are numerous bars and restaurants as well as many places of employment in and near this area, including warehouses, offices and light industrial and transportation firms.

During the year 1947, there were 32 reported accidents at this location, 23 resulting in personal injury. Of these 23 serious




ACCIDENT TOTALS BY TYPES

| TYPE | DAY | NIGHT | TOTAL |
|---|---|---|---|
| FATAL | 0 | 0 | 0 |
| PED INJURY | 8 | 6 | 14 |
| OTHER INJURY | 4 | 3 | 7 |
| PROP DAMAGE | 11 | 11 | 22 |
| TOTAL | 23 | 20 | 43 |

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COLLISION DIAGRAM

# MARKET, SIXTH, GOLDEN GATE & TAYLOR

TRAFFIC CONTROL

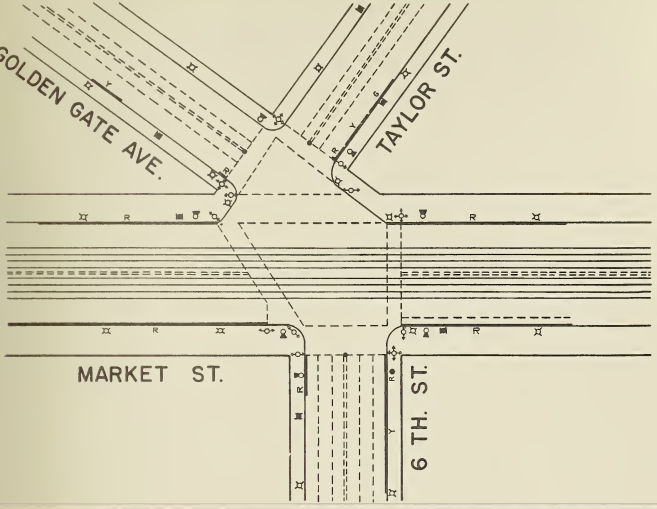
V

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING OR UNPARKING VEHICLE
FIXED OBJECT
REAR END COLLISION
HEAD ON COLLISION
RIGHT ANGLE COLLISION
LEFT TURN COLLISION
SIDE SWIPE
OUT OF CONTROL
REAR END COLLISION WITH BACKING VEHICLE
FATAL ACCIDENT
PERSONAL INJURY
PROPERTY DAMAGE ONLY

1

PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING

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CONDITION DIAGRAM

# MARKET, SIXTH, GOLDEN GATE & TAYLOR

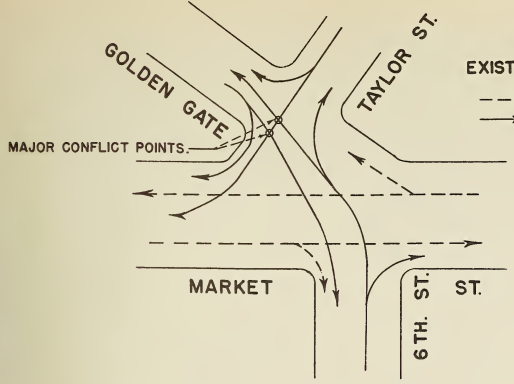
TRAFFIC CONTROL

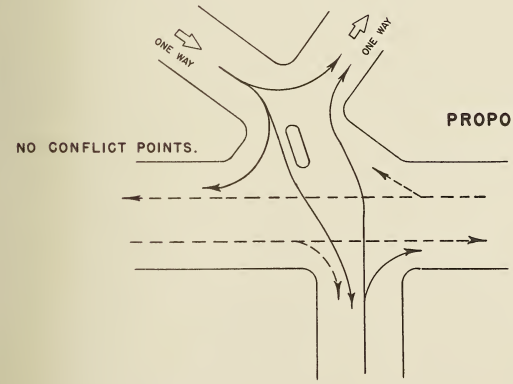
V

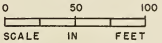
2

PLATE

| | | | |
|---|---|---|---|
| TRAFFIC SIGNAL | ◄○► | HYDRANT | |
| PEDESTRIAN SIGNAL | ◁○▷ | TREE | |
| STOP SIGN | | CAR TRACKS | |
| ELECTRIC STOP SIGN | | PAVEMENT MARKING | |
| PARKING LIMIT SIGN | | PROHIBITED CURB PARKING ZONE | |
| STREET LIGHT | | PASSENGER CURB LOADING ZONE | |
| POWER POLE | | FREIGHT CURB LOADING ZONE | |
| TROLLEY POLE | | TAXI STAND AT CURB | |



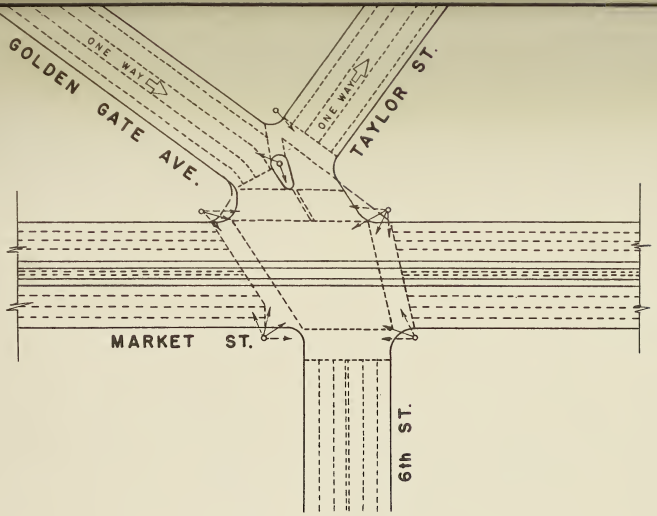






# EXISTING AND PROPOSED TRAFFIC CONTROL PLAN INTERSECTION OF MARKET, 6TH, GOLDEN GATE & TAYLOR.

V
TRAFFIC CONTROL

3
PLATE



# PROPOSED REDESIGN & ONE-WAY STREET PLAN
# INTERSECTION OF MARKET, 6th, GOLDEN GATE & TAYLOR

LEGEND

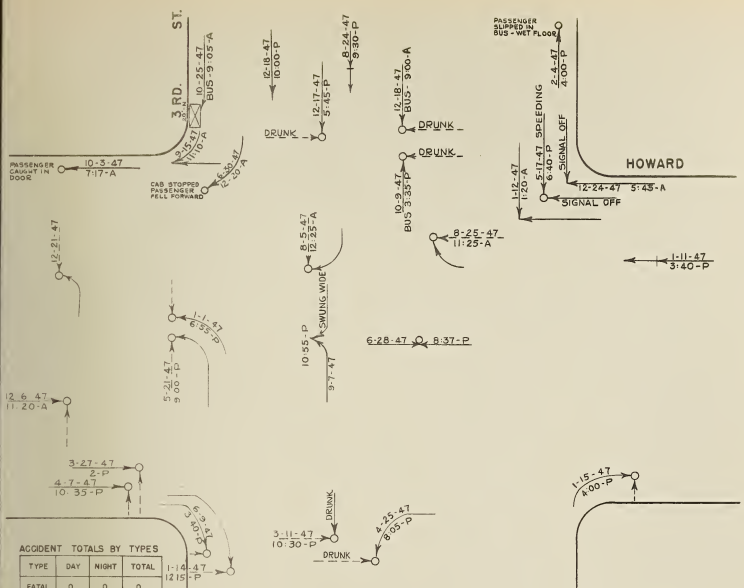
——— EXISTING CURB LINE

- - - - - - - PAVEMENT MARKINGS

TRAFFIC SIGNALS
(DOTTED LINE, PEDESTRIAN SIGNAL
SOLID LINE, VEHICULAR SIGNAL)

V
TRAFFIC CONTROL

4
PLATE




ACCIDENT TOTALS BY TYPES

| TYPE | DAY | NIGHT | TOTAL |
|---|---|---|---|
| FATAL | 0 | 0 | 0 |
| PED. INJURY | 7 | 10 | 18 |
| OTHER INJURY | 3 | 2 | 5 |
| PROP DAMAGE | 4 | 5 | 9 |
| TOTAL | 14 | 18 | 32 |

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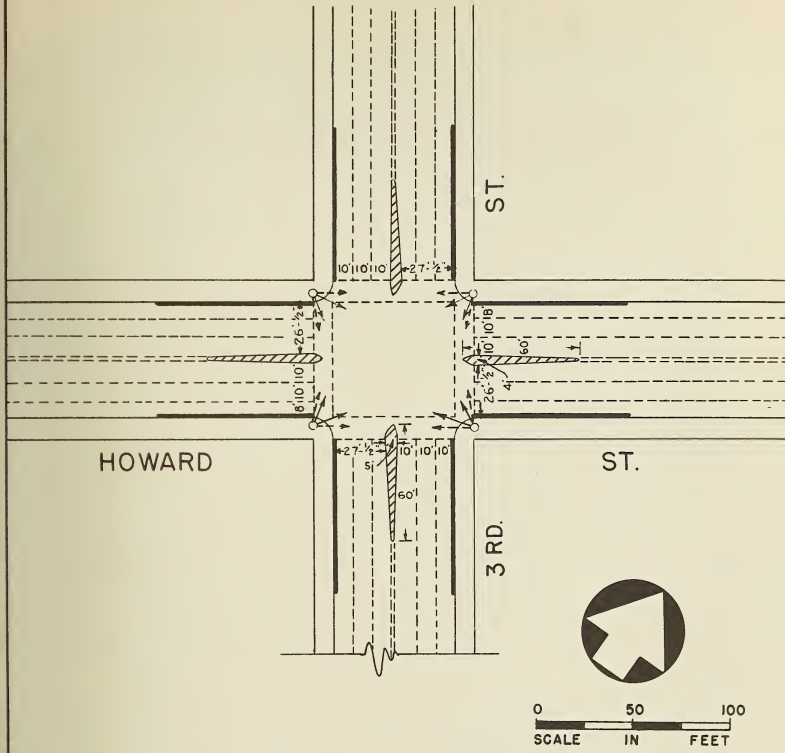
COLLISION DIAGRAM

# HOWARD AT THIRD

TRAFFIC CONTROL V

5 PLATE

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING OR UNPARKING VEHICLE
FIXED OBJECT
REAR END COLLISION
HEAD ON COLLISION
RIGHT ANGLE COLLISION
LEFT TURN COLLISION
SIDE SWIPE
OUT OF CONTROL
REAR END COLLISION WITH BACKING VEHICLE
FATAL ACCIDENT
PERSONAL INJURY
PROPERTY DAMAGE ONLY




# PROPOSED REDESIGN OF INTERSECTION AT HOWARD & THIRD STREETS

TRAFFIC SIGNALS
(DOTTED LINES, PEDESTRIAN SIGNAL
SOLID LINE, VEHICULAR SIGNAL)

PAVEMENT MARKING

NO PARKING ZONE

TRAFFIC ISLAND

V 6

TRAFFIC CONTROL

PLATE

accidents, 18 involved pedestrians, thus constituting the highest incidence of pedestrian accidents for any location in the city. This intersection is second on the list of most hazardous locations.

Fifty-two per cent of pedestrian accidents occurred during hours of darkness. Nine collisions (half of the total) involved right or left turning vehicles all but one of which occurred while signals were operating. Of the nine right-angle vehicle vs. pedestrian collisions, eight occurred while signals were operating, thus indicating violation of right-of-way by one or the other of the parties involved. In thirteen of the eighteen pedestrian accidents, the pedestrian was reported not under the influence of alcohol.

These facts indicate that the pedestrian accident hazard is exceptionally high during hours of darkness; that the hazard during daytime, while less than at night, is exceptionally high with relation to other locations in the city; and that accidents involving pedestrians under the influence of alcohol constitute less than half of the total pedestrian accidents.

Improved Street Lighting Needed

Night accident frequency in terms of exposure to accident is at least three times as high as the daytime rate. This estimate is based upon a comparison of the ratio of accidents that occurred between 7:00 P.M. and 7:00 A.M. to the volume flow for that period and the similar ratio for the 12-hour daytime period. Existing street lighting is substandard according to the American Standard Practice for Street and Highway Lighting (originated by Illuminating Engineering Society and approved by the American Standards Association).

It is recommended that four 10,000 lumen lamps in modern luminaires (giving an asymmetric light distribution) be installed here. Existing lamps give only 6,000 lumens, and are mounted in old-fashioned upright luminaires, which do not direct the light to the pavement where it is needed.

Traffic Islands Needed

Where streets are wide and traffic volumes heavy, center islands are of distinct benefit in reducing all types of accidents. They provide a place of refuge for pedestrians and they channelize vehicular traffic movement, particularly left turns.

It is recommended that traffic center islands be installed on the four approaches to this intersection. It is suggested that each should be five feet wide on Third Street and four feet wide on Howard Street at the crosswalk lines. Center islands should taper down to a one-foot width at the other end with a length of about 60 feet. They should be made of concrete, the same height as the adjacent curbs. "Keep to Right" signs should be installed on these islands facing oncoming traffic. The islands should be installed a little off-center so as to allow a width of 30 feet between the island and the adjacent curb to the right on Third Street (which is 62½ feet in width) and so as to allow 28 feet between the island and the adjacent curb to the right on Howard Street (58½ feet in width). Thus three lanes of traffic can enter the intersection from each approach.

Parking Prohibitions Needed

At present automobiles park at the curbs next to the crosswalks on Howard Street on the west approach. There is no curb marking here to indicate prohibition. Vehicles park on the south approach of Third Street adjacent to the crosswalk too, despite curb markings indicating prohibition.

Because of the hazard to the pedestrians and obstacle to traffic flow at this junction, caused by curb parking, it is recommended that all stopping and parking be prohibited, so marked and firmly enforced for 80 feet on all approaches as shown on the attached plan of intersection redesign (Plate V-6).

Traffic Signal Improvement

Improvements in traffic signal control are needed at this locatin to give pedestrians positive indications in each crosswalk, to give stronger and less easily obscured indications to drivers, and to provide protection during early morning hours when signals are not operating.

Existing signals afford none of these elements of safety. Pedestrians stepping from the curb have signal indications in their line of sight in only half of the locations and even here they receive no indication as to when it is too late to step from the curb in time to reach the opposite curb. Existing signals display no red and green lights during the day - just the legends STOP and GO on a revolving drum. The two lights used to supplement this at night are weak.

It is recommended that new modern 3-light traffic signals be installed at this intersection. They should be equipped with pedestrian walk-wait lenses located so as to face pedestrians crossing each crosswalk in both directions. It is recommended that signals be put onto flashing operation during the hours when normal red-green operation is suspended, flashing red to Howard Street and amber to Third Street.

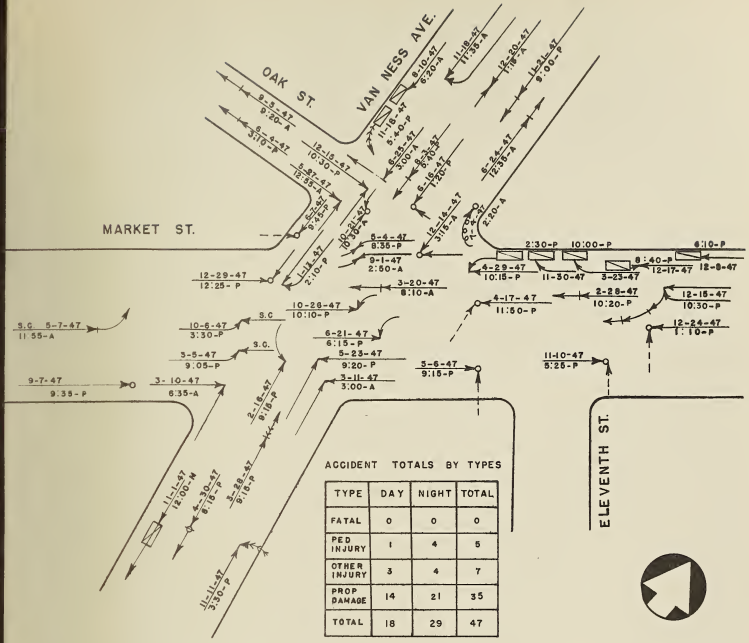
The walk-wait signals should be timed so that the wait light comes on seven seconds before the end of the green signal controlling vehicular movement. Thus pedestrians are warned not to step into the street when it is too late to reach the safety of the center island.

## MARKET STREET AND VAN NESS AVENUE

This complex intersection carries heavy north-south auto and transit traffic on Van Ness Avenue and similar heavy east-west flow on Market Street. In addition it is burdened with a heavy volume from 11th Street. Street cars enter the intersection from all three streets Many transit passengers transfer here and the limits of the intersection are exceptionally wide.

During the year 1947, forty-seven collisions were reported here, 12 resulting in personal injury. It is significant that four out of the five pedestrian accidents and 62 per cent of total collisions occurred at night. Street lighting should be improved here.

Analysis of accidents shows that accident frequency is greatest during the periods of lightest traffic flow. Over half of the




ACCIDENT TOTALS BY TYPES

| TYPE | DAY | NIGHT | TOTAL |
|---|---|---|---|
| FATAL | 0 | 0 | 0 |
| PED INJURY | 1 | 4 | 5 |
| OTHER INJURY | 3 | 4 | 7 |
| PROP DAMAGE | 14 | 21 | 35 |
| TOTAL | 18 | 29 | 47 |

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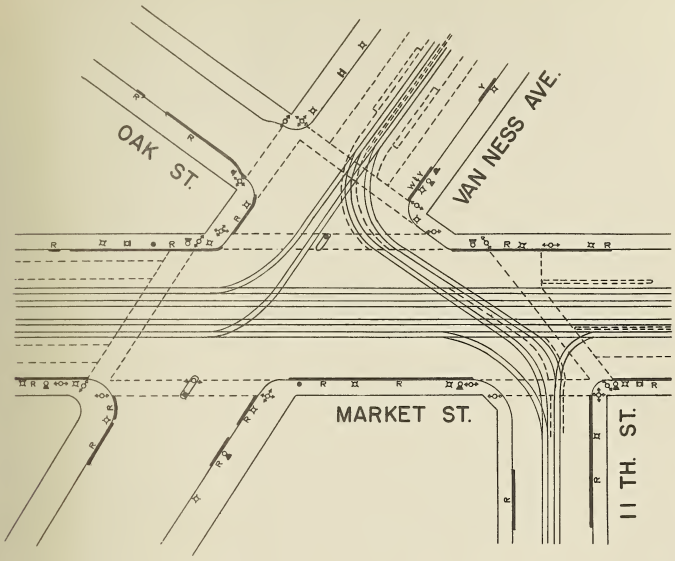
COLLISION DIAGRAM

# MARKET, VAN NESS, OAK & ELEVENTH

TRAFFIC CONTROL V

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING OR UNPARKING VEHICLE
FIXED OBJECT
REAR END COLLISION
HEAD ON COLLISION
RIGHT ANGLE COLLISION
LEFT TURN COLLISION
SIDE SWIPE
OUT OF CONTROL
REAR END COLLISION WITH BACKING VEHICLE
FATAL ACCIDENT
PERSONAL INJURY
PROPERTY DAMAGE ONLY

7 PLATE

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CONDITION DIAGRAM

# MARKET, VAN NESS, OAK & ELEVENTH

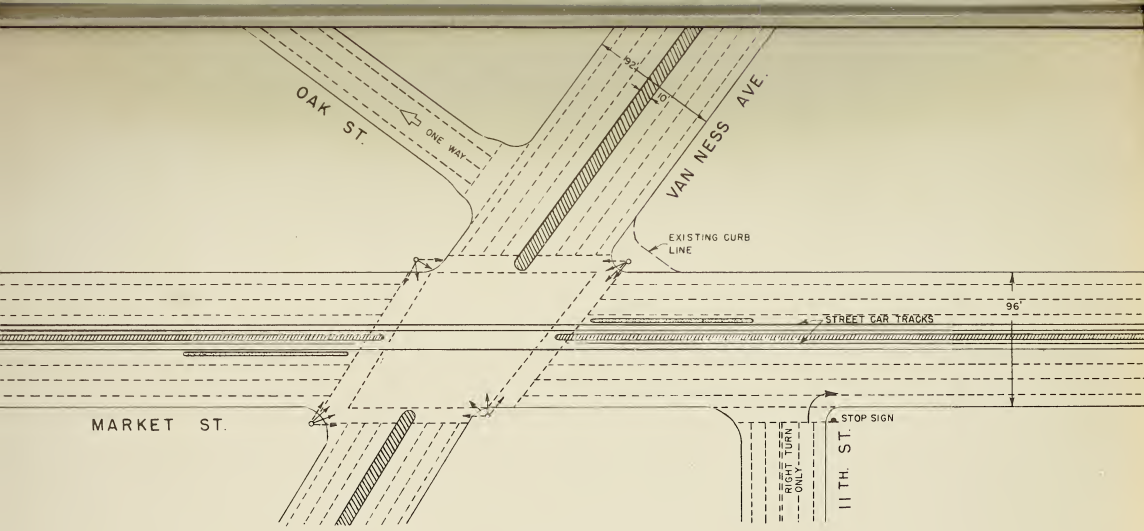
TRAFFIC CONTROL

V

8

PLATE

| | | | |
|---|---|---|---|
| TRAFFIC SIGNAL | ◄○► | HYDRANT | ∞ |
| PEDESTRIAN SIGNAL | ◁○▷ | TREE | |
| STOP SIGN | T | CAR TRACKS | |
| ELECTRIC STOP SIGN | T | PAVEMENT MARKING | |
| PARKING LIMIT SIGN | H | PROHIBITED CURB PARKING ZONE | |
| STREET LIGHT | ☼ | PASSENGER CURB LOADING ZONE | |
| POWER POLE | ⊕ | FREIGHT CURB LOADING ZONE | |
| TROLLEY POLE | ● | TAXI STAND AT CURB | |




# PROPOSED REDESIGN AND TRAFFIC CONTROL PLAN INTERSECTION OF MARKET, VAN NESS, OAK & 11TH

0 50 100
SCALE IN FEET

TRAFFIC CONTROL SIGNALS
(DOTTED LINE, PEDESTRIAN SIGNAL
SOLID LINE, VEHICULAR SIGNAL)

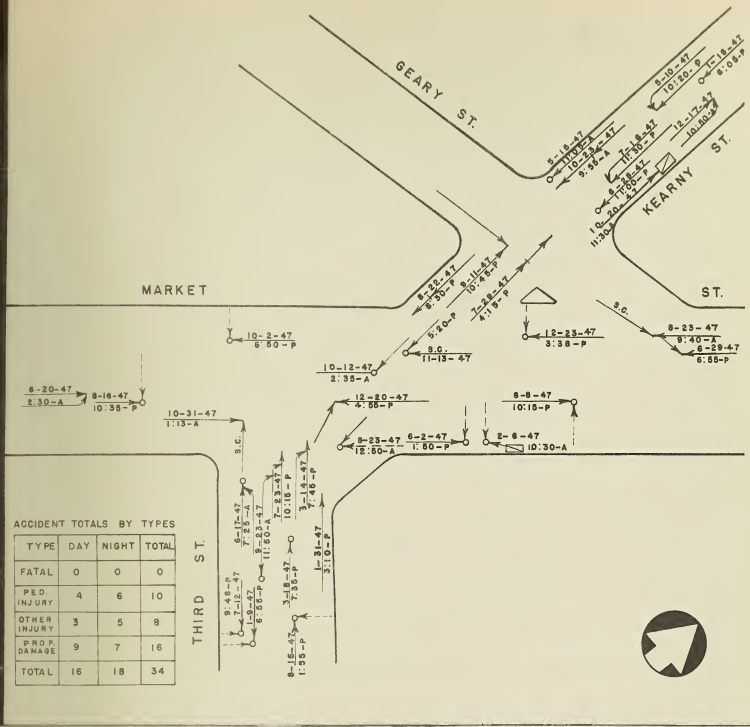
TRAFFIC DIVIDING ISLANDS

PAVEMENT MARKINGS

LOADING ISLANDS

V TRAFFIC CONTROL

9 PLATE




ACCIDENT TOTALS BY TYPES

| TYPE | DAY | NIGHT | TOTAL |
|---|---|---|---|
| FATAL | 0 | 0 | 0 |
| PED. INJURY | 4 | 6 | 10 |
| OTHER INJURY | 3 | 5 | 8 |
| PROP. DAMAGE | 9 | 7 | 16 |
| TOTAL | 16 | 18 | 34 |

DE LEUW, CATHER & CO., CONSULTING ENGINEERS • LADISLAS SEGOE, CONSULTING CITY PLANNER • OCTOBER 1948

COLLISION DIAGRAM

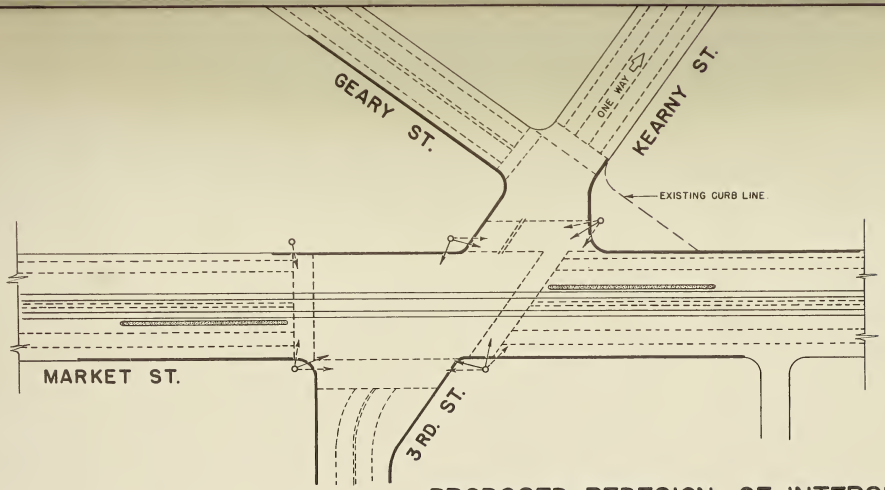
# MARKET, THIRD, KEARNEY & GEARY

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING OR UNPARKING VEHICLE
FIXED OBJECT
REAR END COLLISION
HEAD ON COLLISION
RIGHT ANGLE COLLISION
LEFT TURN COLLISION
SIDE SWIPE
OUT OF CONTROL
REAR END COLLISION WITH BACKING VEHICLE
FATAL ACCIDENT
PERSONAL INJURY
PROPERTY DAMAGE ONLY

TRAFFIC CONTROL V

10 PLATE

SAN FRANCISCO DEPARTMENT OF CITY PLANNING




# PROPOSED REDESIGN OF INTERSECTION AT MARKET, 3 RD., KEARNY AND GEARY

0 50 100
SCALE IN FEET

L E G E N D

- TRAFFIC CONTROL SIGNALS (DOTTED LINE, PEDESTRIAN SIGNALS SOLID LINE, VEHICULAR SIGNALS)
- PAVEMENT MARKING
- PASSENGER LOADING ISLAND
- NO STOPPING ZONE

V TRAFFIC CONTROL

PLATE 11

collisions occurred between 8:00 P.M. and 3:00 A.M. This situation is explained by the fact that the intersection is so large, with so many possible routes of travel, that speeds are high and chances for confusion great. The roadways of both Van Ness Avenue and Market Street are over 90 feet in width. Westbound vehicles travel a distance of 300 feet across the intersection.

In order to properly channelize and control traffic at this junction, the following improvements are recommended:

Make Oak Street one-way westbound to Gough Street. This will simplify traffic control and signal timing by eliminating an entering traffic stream. Install traffic dividing islands on all four approaches to the intersection of Market Street and Van Ness Avenue. These are shown in the attached drawing. The purpose of these islands is to channelize movements, especially left turns, and to give pedestrians a refuge in the middle of the wide streets; and

Narrow the intersection down by allowing right turns only into and out of 11th Street, by providing signal control at Van Ness Avenue and Market Street as shown and by building out the curb line on the northeast corner. This will reduce the amount of dead space in which confusing movements are possible and simplify and improve signal timing by reducing the clearance intervals needed.

## MARKET AND THIRD STREETS

This five point intersection stands fourth on the list of most hazardous locations. It is located in the geographical center of the business district and hence vehicular and pedestrian volumes are consistently high throughout the day. Thirty-four collisions were reported here last year, 18 resulting in personal injury, 10 of which involved pedestrians. Conflicting traffic movements here exist because of the fact that southbound Kearny Street traffic moves at the same time as eastbound Geary Street traffic moves. The latter movement also conflicts with northbound Third Street traffic into Kearny Street.

It is interesting to note that this intersection appeared second on the list of most hazardous locations in the 1938 survey. During 1936, thirty-four collisions had been reported, identical with the number reported in 1947. The physical conditions at this junction are the same today as they were in 1936.

Most of the accidents here result from the unusual shape of the intersection and the traffic conflicts mentioned. As shown by the collision diagram the accident types are varied, including rear-end, right-angle, turning and pedestrian collisions.

It is significant that the intersection of Market and Montgomery Streets, one block east, which also carries large traffic volumes, experienced only seven reported collisions in the year 1947, or one-fifth of those at Kearny Street. This is attributed largely to the fact that Montgomery is a one-way street, which eliminates possible traffic conflicts. The 1938 city wide traffic survey showed Market and Montgomery Streets to be third on the list of most hazardous locations, with 29 accidents reported, 20 involving injuries. Market and

Kearny Streets was second on the list with 34 accidents at that time. Since then, Montgomery Street was made a one-way street. Today the Montgomery Street intersection does not appear in the list of forty most hazardous locations while Market and Third Streets is still one of the most hazardous intersections in San Francisco. This is a good example of the improvement brought about by reducing extraneous conflicts through one-way treatment and serves to indicate the benefit that will accrue at Market and Kearny Streets by similar treatment.

It is recommended (under the one-way street plan) that Kearny Street be made one-way northbound. This will eliminate the three existing major traffic conflicts. The ten collisions reported last year which involved southbound traffic from Kearny Street could not take place under the one-way plan.

It is recommended that the curb line at the northeast corner be relocated as shown on the attached sketch, to confine and further reduce the intersection area and properly channelize intersection movements. Removal of the Geary Street car tracks leading into Market Street will be accomplished in the future, making it possible to further improve this intersection.

Traffic emerging from Geary Street should not be allowed to make a left turn into Market Street. The required signal clearance interval here will be reduced by shortening the intersection limits because with Kearny Street made one-way northbound, Geary Street traffic can be stopped at the north line of Market Street instead of at the west line of Kearny Street as at present. This will simplify and improve signal timing.

Under the proposed downtown transit routing plan the only transit vehicle movements on Geary Street at this junction will be westbound buses making a right turn from Market Street. The eastbound Geary buses are routed into Market Street on O'Farrell Street where no left turn conflict will be caused.

## HOWARD AND SIXTH STREETS

This is a regular right-angle signalized intersection in the warehouse and wholesale district. During the day it carries a considerable volume of mixed traffic. There is a decided decrease in traffic flow after the business day is over. The street car tracks on Sixth Street will be removed in the future.

During 1947, twenty-seven accidents were reported at this intersection, sixteen resulting in personal injury, all of which involved pedestrians, putting this intersection fifth on the list of most hazardous locations.

Twelve of the sixteen pedestrian accidents happened during hours of darkness, all but one while the traffic signals were in operation. In eight or 50 per cent of the cases, the pedestrian was reported under the influence of alcohol. Eleven of the sixteen pedestrian accidents involved persons crossing Howard Street. It is apparent that the major problem is that of pedestrian safety, particularly between 6:00 P.M. and midnight.

There were eleven vehicle vs. vehicle collisions (none of which resulted in personal injury) during the year 1947. Night accidents constituted 45 per cent of the total. Two were rear-end collisions. Four involved turning vehicles while five were right-angle collisions.

Three of the latter occurred at the time of signal change, when there is a 2-1/2 second clearance period. A longer clearance period in the signal timing would assist in preventing this type of collision.

The vehicle vs. vehicle accident problem is not hinged to any one particular cause or factor. The general effects of street lighting, channelization and improved signal control here recommended will be to introduce more orderly movement and more positive traffic control.

Street Lighting Improvement

Although traffic volume is relatively low here at night, accident frequency is high. Adequate street lighting is needed to reduce this abnormal night time hazard. This hazard is 3-1/2 times the daytime hazard. At present there are four street lights situated at this intersection, each equipped with 6,000 lumen lamps, a great part of the light being directed upwards.

It is recommended that modern type lighting be installed immediately with 10,000 lumen lamps and modern luminaires (with asymmetric reflectors).

Traffic Islands

It is recommended that traffic islands be installed on all four approaches to this intersection. These should be similar to the ones recommended at Third and Howard Streets and shown on Plate V-6 covering that intersection. The two islands on Sixth Street should be five feet in maximum width while those on Howard Street should be a foot narrower. The design of the islands should conform generally to that suggested at the Third-Howard intersection. By affording the pedestrian a place of refuge in the center of the street, his chances of being struck are much less than without such protection. The islands will add to safety of vehicular movement too, by channelizing turning movements.

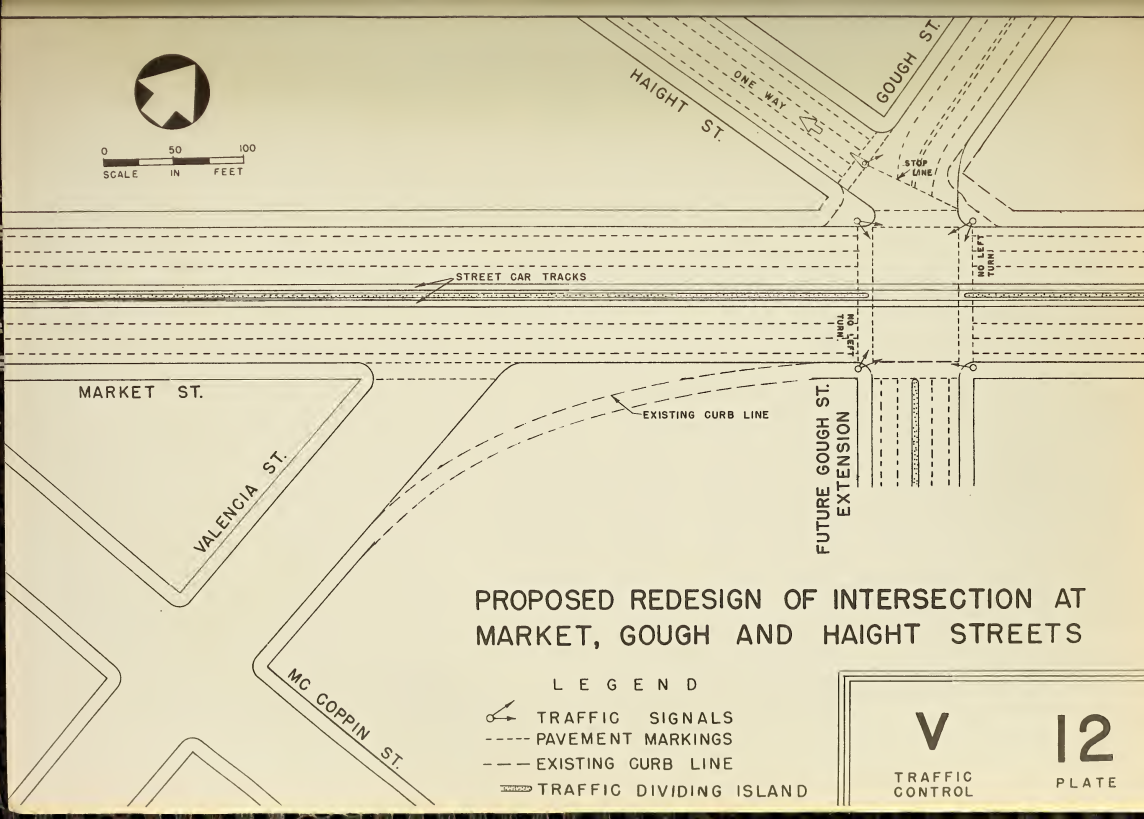
Traffic Signal Improvements

It is recommended that modern 3-light traffic signals be substituted here for the existing signals. Special pedestrian walk-wait lenses should be included and located so as to afford continuous indications for pedestrians, in line of sight, crossing in each crosswalk in both directions.

This new equipment will provide more brilliant signal indications than at present, thus affording better control. With a far left indication, drivers will not be handicapped or endangered by having the far right indication obscured by truck or bus bodies. Pedestrians will be given positive indications directly in line with their paths.

It is recommended that the signals be put on flashing operation during the times that normal operation is suspended (1:00 A.M. to 7:00 A.M. on weekdays and 1:00 A.M. to 1:30 P.M. on Sundays). A number of accidents occurred last year during these early morning hours when the signals were not operating. Flashing red should be shown to Howard Street (requiring traffic to stop) and flashing amber (requiring caution) should be shown to Sixth Street. It is further recommended that the signal clearance period be lengthened to four seconds to afford more protection to clearing traffic.

It is also suggested that curb parking be prohibited on both sides of each street for a distance of 80 feet back from the intersection. (See Plate V-6 for Third and Howard Streets).




# PROPOSED REDESIGN OF INTERSECTION AT MARKET, GOUGH AND HAIGHT STREETS

LEGEND

- TRAFFIC SIGNALS
- PAVEMENT MARKINGS
- EXISTING CURB LINE
- TRAFFIC DIVIDING ISLAND

V TRAFFIC CONTROL

12 PLATE

## MARKET, GOUGH AND HAIGHT STREETS

This junction, sixth on the list of most hazardous intersections, was the scene of 34 reported collisions during the year 1947. Six involved pedestrian injuries and four involved vehicle occupant injury. Fifteen of these involved rear-end and right-angle collisions.

This junction is a complex intersection with many possible conflicts. The irregularity of traffic movements has manifested itself in the many rear-end and right-angle collisions, indicative of need for better control and simpler traffic movements. At present there is no traffic control other than stop signs on Haight Street and Valencia Street.

The accompanying sketch shows a proposed redesign of this intersection which will substantially reduce frequency of accidents and traffic delays. The extension of Gough Street south from Market Street to be completed in the near future is shown. The changes proposed over present operation are as follows:

1. Traffic signals are proposed. The extension of Gough Street will make the need for such control even greater than at present.

2. Haight Street is proposed to be made one-way westbound to Laguna Street. This will simplify the signal control and reduce points of conflict in paths of vehicular movement.

3. A center island is proposed on Market Street to prevent traffic from crossing Market Street in the area between Valencia Street and Gough Street (north of Market). This movement is judged to be one of the major causes of vehicular collisions and accidents.

Eastbound drivers in Market Street desiring to proceed north in Gough Street can go one block further to Franklin Street and there make a left turn with greater safety and less inconvenience. Westbound Market Street traffic desiring to go south at Valencia Street can proceed west into Haight or Waller Streets and turn left onto Laguna Street, proceeding south directly across Market Street into Guerrero Street with traffic signal protection at Laguna, Guerrero and Market Streets. A stop line and island installed as shown in and Gough Street throat will shorten the intersection clearance distance for southbound Gough Street traffic, thus facilitating and improving the efficiency of traffic signal timing.

TABLE I

PARKING INVENTORY
METROPOLITAN PARKING DISTRICT
AS OF JANUARY 1, 1948

| At Street Curb | Number of Car Stalls | |
|---|---|---|
| 10-Minute Zones | 265 | |
| 40-Minute Zones | 2,985 | |
| 60-Minute Zones | 5,692 | |
| 120-Minute Zones | 139 | |
| Miscellaneous Time Limit Zones | 27 | |
| Unlimited Zones | 4,145 | |
| Total - Legal Parking Stalls | | 13,253 |
| Truck and Taxi Zones | 2,076 | |
| Passenger Loading Zones (white curb not for buses) | 582 | |
| Parking Prohibited Zones (red curb) | 5,001 | |
| Parking Prohibited Zones (signs only) | 4,790 | |
| Total - No Parking Stalls | | 12,449 |
| Total - Curb Stalls | | 25,702 |
| **Off-Street** | | |
| Public Garages | 12,409 | |
| Public Lots | 8,012 | |
| Total - Public Stalls | | 20,421 |
| Private Garages | 1,088 | |
| Private Lots | 736 | |
| Total - Private Stalls | | 1,824 |
| Total - Off-Street Stalls | | 22,245 |

TABLE II

CURB PARKING TURNOVER
METROPOLITAN PARKING DISTRICT
NORMAL WEEKDAY - SEPTEMBER 1948

| At Street Curb | Number of Stalls | Present Turnover - Number of Autos Parked Between 7:00 A.M. and 7:00 P.M. Per Stall | Total Turnover |
|---|---|---|---|
| 10 and 20-Minute Zones | 278 | 8.0 | 2,220 |
| 40-Minute Zones | 2,985 | 6.0 | 17,900 |
| 60-Minute Zones | 5,692 | 3.2 | 18,200 |
| 120-Minute Zones | 139 | 2.5 | 347 |
| Miscellaneous Time Limit Zones | 14 | 2.5 | 35 |
| Unlimited Zones | 4,145 | 2.5 | 10,368 |
| Total - Legal Parking | 13,253 | | 49,070 |
| Commercial Zones (taxi stands, truck and passenger loading zones) | 2,658 | 3.0 | 7,970 |
| No Parking (red curb) | 5,001 | 0.47 | 2,360 |
| No Parking (signs only) | 4,790 | 2.5 | 12,000 |
| Total - Illegal Parking | 12,449 | | 22,330 |
| Grand Total | 25,702 | | 71,400 |

## TABLE III - CURB PARKING DURATIONS

Metropolitan Parking District

Normal Weekday - September 1948

| Duration of Parking | 10 - 20 Minute Zones | | | | 40 Minute Zones | | | | 60 Minute Zones | | | | Unlimited Zones | | | | Taxi & Truck Loading Zones | | | | Passenger Loading Zones | | | | No Parking Zones | | | | Double Parking | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Autos | | Trucks | | Autos | | Trucks | | Autos | | Trucks | | Autos | | Trucks | | Autos | | Trucks | | Autos | | Trucks | | Autos | | Trucks | | Autos | | Trucks | |
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| 20 Minutes | 34 | 34 | 1 | 50 | 267 | 24 | 44 | 43 | 164 | 23 | 66 | 43 | 2 | 8 | 2 | 20 | 142 | 44 | 119 | 52 | 2 | 33 | 2 | 25 | 437 | 45 | 406 | 58 | 26 | 62 | 41 | 76 |
| 40 Minutes | 24 | 24 | 1 | 50 | 244 | 22 | 23 | 22 | 130 | 19 | 34 | 22 | 2 | 8 | 2 | 20 | 69 | 21 | 52 | 23 | 1 | 17 | 2 | 25 | 205 | 21 | 144 | 21 | 3 | 7 | 8 | 15 |
| 60 Minutes | 17 | 17 | 0 | 0 | 138 | 13 | 13 | 13 | 83 | 12 | 19 | 12 | 1 | 4 | 3 | 30 | 42 | 13 | 20 | 9 | 0 | 0 | 2 | 3 | 97 | 10 | 62 | 9 | 3 | 7 | 2 | 4 |
| 1 Hr. 20 Min. | 12 | 12 | 0 | 0 | 96 | 9 | 2 | 2 | 45 | 6 | 5 | 3 | 1 | 4 | 0 | 0 | 25 | 8 | 13 | 6 | 0 | 0 | 1 | 13 | 48 | 5 | 30 | 4 | 2 | 5 | 2 | 4 |
| 1 Hr. 40 Min. | 5 | 5 | 0 | 0 | 58 | 5 | 5 | 5 | 40 | 6 | 6 | 4 | 1 | 4 | 1 | 10 | 12 | 4 | 10 | 4 | 0 | 0 | 1 | 12 | 57 | 6 | 10 | 1 | 0 | 0 | 0 | 0 |
| 2 Hrs. | 0 | 0 | 0 | 0 | 44 | 4 | 1 | 1 | 22 | 3 | 1 | 1 | 1 | 4 | 1 | 10 | 8 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 18 | 2 | 8 | 1 | 2 | 5 | 1 | 2 |
| 2 Hrs. 20 Min. | 1 | 1 | 0 | 0 | 23 | 2 | 4 | 4 | 27 | 4 | 2 | 1 | 1 | 4 | 0 | 0 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 2 | 5 | 1 | 0 | 0 | 0 | 0 |
| 2 Hrs. 40 Min. | 0 | 0 | 0 | 0 | 26 | 2 | 1 | 1 | 12 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 1 | 17 | 0 | 0 | 8 | 1 | 3 | 0 | 0 | 0 | 0 | 0 |
| 3 Hrs. | 0 | 0 | 0 | 0 | 33 | 3 | 0 | 0 | 4 | 1 | 0 | 0 | 1 | 4 | 0 | 0 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 1 | 6 | 1 | 1 | 2 | 0 | 0 |
| 3 - 6 Hrs. | 3 | 3 | 0 | 0 | 111 | 10 | 7 | 7 | 93 | 13 | 13 | 8 | 6 | 24 | 1 | 10 | 10 | 3 | 8 | 4 | 2 | 33 | 0 | 0 | 51 | 5 | 19 | 3 | 2 | 5 | 0 | 0 |
| Over 6 Hrs. | 4 | 4 | 0 | 0 | 67 | 6 | 2 | 2 | 78 | 11 | 8 | 5 | 9 | 36 | 0 | 0 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 26 | 2 | 5 | 1 | 3 | 7 | 0 | 0 |
| Total | 100 | | 2 | | 1107 | | 102 | | 698 | | 156 | | 25 | | 10 | | 326 | | 230 | | 6 | | 8 | | 975 | | 698 | | 42 | | 54 | |
| Average Duration | 1 Hour - 18 Min. | | - | | 1 Hour - 43 Min. | | 1 Hr. - 6 Min. | | 2 Hrs. | | 1 Hr. - 17 Min. | | 4 Hrs. - 32 Min. | | - | | 57 Min. | | 49 Min. | | - | | - | | 1 Hr. - 9 Min. | | 45 Min. | | 1 Hr. - 12 Min. | | 29 Min. | |
| Per Cent Parked Overtime | 66% | | - | | 54% | | 34% | | 46% | | 24% | | - | | - | | - | | - | | - | | - | | 100% | | 100% | | - | | - | |

TABLE IV

OFF-STREET PARKING TURNOVER IN PUBLIC FACILITIES
METROPOLITAN PARKING DISTRICT
7:00 A.M. to 7:00 P.M.
DECEMBER 1948

| | Public Garages | Public Lots | Total |
|---|---|---|---|
| Capacity Stalls | 12,409 | 8,012 | 20,421 |
| Reported Turnover | 15,795 | 11,590 | 27,385 |
| Calculated Turnover per Stall | 1.3 | 1.5 | - |
| Maximum Practical Turnover per Stall | 2.0 | 3.0 | - |
| Maximum Practical Total Turnover | 24,800 | 24,000 | 48,800 |
| Present Operation - Per Cent of Maximum Practical | 64% | 47% | 56% |

TABLE V

ALL-DAY PARKERS
METROPOLITAN PARKING DISTRICT
NORMAL WEEKDAY - SEPTEMBER 1948

| Location of Parking | All-Day Parkers |
|---|---|
| In 40-Minute Zones | 1,830 |
| In 60-Minute Zones | 2,000 |
| In Unlimited Zones | 3,730 |
| In Taxi and Loading Zones | 960 |
| In No Parking Zones | 250 |
| In Miscellaneous Zones | 90 |
| Total | 8,860 |

TABLE VI
ANALYSIS OF OFF-STREET PARKING TURNOVER
METROPOLITAN PARKING DISTRICT
NORMAL WEEKDAY - DECEMBER 1947 AND JANUARY 1948

| Segment | Car Stalls Capacity | Present Turnover 7:00 A.M.-7:00 P.M. | Per Stall | Maximum Practical Turnover | Present Turnover Per Cent of Maximum |
|---|---|---|---|---|---|
| 01 | 1,097 | 1,937 | 1.76 | 2,450 | 79 |
| 02 | 1,759 | 3,285 | 1.87 | 3,580 | 92 |
| 03 | 731 | 1,370 | 1.87 | 1,590 | 86 |
| 04 | 2,095 | 3,082 | 1.48 | 4,960 | 62 |
| 05 | 692 | 813 | 1.17 | 1,460 | 51 |
| 06 | 693 | 1,060 | 1.53 | 2,300 | 46 |
| 07 | 556 | 755 | 1.36 | 1,530 | 50 |
| 08 | 431 | 780 | 1.80 | 1,160 | 67 |
| 09 | 868 | 1,671 | 1.93 | 2,390 | 70 |
| 12° | 734 | 1,594 | 2.18 | 1,760 | 90 |
| 13° | 480 | 520 | 1.08 | 1,370 | 38 |
| 14 | 1,833 | 1,568 | 0.85 | 4,280 | 37 |
| 15 | 1,169 | 490 | 0.42 | 3,470 | 14 |
| 16 | 422 | 394 | 0.93 | 1,170 | 34 |
| 41° | 27 | 27 | 1.0 | 80 | 33 |
| 61 | 913 | 1,133 | 1.24 | 2,630 | 43 |
| 71° | 1,280 | 1,358 | 1.06 | 2,650 | 51 |
| 72 | 2,801 | 2,955 | 1.05 | 6,160 | 48 |
| 73° | 356 | 372 | 1.04 | 820 | 46 |
| 74 | 284 | 429 | 1.51 | 850 | 50 |
| 91° | 1,050 | 1,685 | 1.60 | 2,230 | 76 |

°-Partial Segment

TABLE VI

ABILITIES OF SIX-GRADE SPELLING CHAMPIONS
DISTRIBUTED ACCORDING TO SCORES
NORMAL MORALITY - BEGINNING JULY 1, CLOSING JUNE

| Students | Use Spelling Vocabulary | Personal Dictionary (1500 A.D.-1500 B.C.) | Use Dictionary | Habitual Spelling Conscience | Number Times Each Word Is Used in Sentences |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

## TABLE VII

### PARKING RATES IN PARKING GARAGES AND LOTS CENTRAL PARKING DISTRICT

| Parking Duration | Average Parking Charge In 33 Public Garages | 55 Public Lots |
|---|---|---|
| 1 Hour | $0.47 | $0.34 |
| 2 Hours | 0.50 | 0.38 |
| 3 Hours | 0.60 | 0.44 |
| 4 Hours | 0.60 | 0.48 |
| 5 Hours | 0.67 | 0.52 |
| 6 Hours | 0.68 | 0.54 |
| 7 Hours | 0.68 | 0.55 |
| 8 Hours | 0.68 | 0.56 |
| 9 Hours | 0.69 | 0.57 |
| 10 Hours | 0.69 | 0.60 |
| 11 Hours | 0.69 | 0.60 |
| 12 Hours | 0.70 | 0.60 |
| 24 Hours | 0.75 | 0.61 |

[illegible]

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| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |

TABLE VIII

DESTINATIONS OF PERSONS TRAVELING TO
METROPOLITAN PARKING DISTRICT
7:00 A.M. to 7:00 P.M. - NORMAL WEEKDAY - 1946-1947

| Destination Segment | Workers | | | | Others | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Auto Drivers | Auto Pass. | Transit Pass. | Total | Auto Drivers | Auto Pass. | Transit Pass. | Total | Auto Drivers | Auto Pass. | Transit Pass. | Total |
| 01 | 5,583 | 3,406 | 20,412 | 29,401 | 3,492 | 1,104 | 1,852 | 6,448 | 9,075 | 4,510 | 22,264 | 35,849 |
| 02 | 2,679 | 1,227 | 11,902 | 15,808 | 4,760 | 3,519 | 10,495 | 18,774 | 7,439 | 4,746 | 22,397 | 34,582 |
| 03 | 1,620 | 578 | 2,771 | 4,969 | 2,695 | 2,043 | 5,169 | 9,907 | 4,315 | 2,621 | 7,940 | 14,876 |
| 04 | 1,229 | 233 | 1,398 | 2,860 | 1,638 | 1,079 | 2,149 | 4,866 | 2,867 | 1,312 | 3,547 | 7,726 |
| 05 | 5,008 | 2,034 | 19,528 | 26,570 | 3,335 | 1,487 | 6,241 | 11,063 | 8,343 | 3,521 | 25,769 | 37,633 |
| 06 | 3,644 | 1,903 | 14,740 | 20,287 | 7,186 | 4,940 | 27,998 | 40,124 | 10,830 | 6,843 | 42,738 | 60,411 |
| 07 | 3,888 | 1,079 | 11,997 | 16,964 | 1,887 | 1,323 | 3,985 | 7,195 | 5,775 | 2,402 | 15,982 | 24,159 |
| 08 | 1,598 | 498 | 2,468 | 4,564 | 930 | 545 | 1,522 | 2,997 | 2,528 | 1,043 | 3,990 | 7,561 |
| 09 | 1,162 | 290 | 2,323 | 3,775 | 1,165 | 823 | 2,241 | 4,229 | 2,327 | 1,113 | 4,564 | 8,004 |
| 12* | 5,000 | 1,385 | 8,950 | 15,335 | 1,950 | 795 | 2,700 | 5,445 | 6,950 | 2,180 | 11,650 | 20,780 |
| 13* | 2,320 | 735 | 2,950 | 6,005 | 410 | 197 | 2,020 | 2,627 | 2,730 | 932 | 4,970 | 8,632 |
| 14 | 3,527 | 1,111 | 3,635 | 8,273 | 982 | 420 | 2,602 | 4,004 | 4,509 | 1,531 | 6,237 | 12,277 |
| 15 | 2,600 | 716 | 2,053 | 5,369 | 1,091 | 637 | 1,444 | 3,172 | 3,691 | 1,353 | 3,497 | 8,541 |
| 16 | 4,525 | 1,138 | 3,328 | 8,991 | 1,131 | 323 | 2,025 | 3,479 | 5,656 | 1,461 | 5,353 | 12,470 |
| 41* | 1,640 | 328 | 1,210 | 3,178 | 720 | 352 | 820 | 1,892 | 2,360 | 680 | 2,030 | 5,070 |
| 61 | 3,680 | 1,123 | 3,942 | 8,745 | 3,240 | 1,682 | 4,622 | 9,544 | 6,920 | 2,805 | 8,564 | 18,289 |
| 71* | 2,250 | 607 | 2,480 | 5,337 | 4,800 | 3,393 | 8,070 | 16,263 | 7,050 | 4,000 | 10,550 | 21,600 |
| 72 | 3,204 | 598 | 2,453 | 6,255 | 3,204 | 1,703 | 6,378 | 11,285 | 6,408 | 2,301 | 8,831 | 17,540 |
| 73* | 2,295 | 466 | 1,853 | 4,614 | 4,085 | 1,804 | 3,023 | 8,912 | 6,380 | 2,270 | 4,876 | 13,526 |
| 74 | 2,514 | 1,280 | 4,566 | 8,360 | 2,346 | 1,039 | 2,876 | 6,261 | 4,860 | 2,319 | 7,442 | 14,621 |
| 91* | 2,720 | 940 | 3,460 | 7,120 | 2,840 | 1,760 | 6,740 | 11,340 | 5,560 | 2,700 | 10,200 | 18,460 |
| Total | 62,686 | 21,675 | 128,419 | 212,780 | 53,887 | 30,968 | 104,972 | 189,827 | 116,573 | 52,643 | 233,391 | 402,607 |

*-Partial BAMTS Segment (see map of area covered).

TABLE IX

SHORTAGE OF PARKING SPACES
METROPOLITAN PARKING DISTRICT
ANALYSIS OF SUPPLY AND DEMAND BY SEGMENTS

| Segment | 1948 Destinations | 1948 Maximum Practical Turnover** | 1948 Excess Destinations | 1948 Car Stalls Needed | 1970 Destinations | 1970 Maximum Practical Turnover** | 1970 Excess Destinations | 1970 Car Stalls Needed |
|---|---|---|---|---|---|---|---|---|
| 01 | 9,075 | 6,584 | 2,491 | 1,245 | 10,900 | 4,130 | 6,770 | 3,380 |
| 02 | 7,439 | 4,467 | 2,972 | 1,486 | 8,900 | 3,790 | 5,110 | 2,550 |
| 03 | 4,315 | 1,978 | 2,337 | 1,168 | 5,170 | 1,980 | 3,190 | 1,600 |
| 04 | 2,867 | 8,590 | 5,723 | -2,861 | 3,450 | 7,700 | -4,250 | -2,130 |
| 05 | 8,343 | 3,890 | 4,453 | 2,227 | 10,000 | 3,510 | 6,490 | 3,240 |
| 06 | 10,830 | 5,015 | -5,815 | 2,907 | 13,000 | 4,260 | 8,740 | 4,370 |
| 07 | 5,775 | 5,032 | 743 | 371 | 6,950 | 4,610 | 2,340 | 1,170 |
| 08 | 2,528 | 2,066 | 462 | 231 | 3,040 | 1,860 | 1,180 | 590 |
| 09 | 2,327 | 4,397 | -2,070 | -1,035 | 2,800 | 4,330 | -1,530 | -770 |
| Total - Central Parking District | 53,499 | 42,019 | 11,480 | 5,739 | 64,210 | 36,170 | 28,040 | 14,000 |
| 12* | 6,950 | 12,292 | - | - | 8,340 | 8,740 | - | - |
| 13* | 2,730 | 7,523 | - | - | 3,280 | 4,610 | - | - |
| 14 | 4,509 | 13,355 | - | - | 5,410 | 9,080 | - | - |
| 15 | 3,691 | 14,382 | - | - | 4,430 | 10,940 | - | - |
| 16 | 5,656 | 20,987 | - | - | 6,800 | 13,740 | - | - |
| 41* | 2,360 | 6,300 | - | - | 2,830 | 3,580 | - | - |
| 61 | 6,920 | 12,181 | - | - | 8,310 | 8,310 | - | - |
| 71* | 7,050 | 16,314 | - | - | 8,460 | 10,060 | - | - |
| 72 | 6,405 | 22,126 | - | - | 7,700 | 16,780 | - | - |
| 73* | 6,330 | 11,999 | - | - | 7,650 | 17,470 | - | - |
| 74 | 4,860 | 7,781 | - | - | 5,840 | 6,250 | - | - |
| 91* | 5,560 | 24,684 | - | - | 6,680 | 7,690 | - | - |
| Total - Remainder of Metropolitan Parking District | 63,074 | 169,924 | - | - | 75,730 | 117,450 | - | - |

*-Partial BAMTS Segments (See Figure 1).

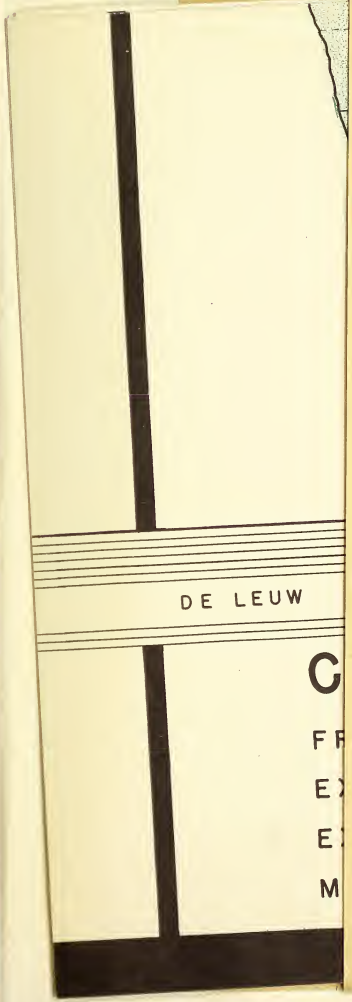
**-Assumes 100 per cent compliance with parking time limit regulations.

App. B

## TABLE X

### COST COMPARISON OF VARIOUS TYPES OF PARKING TO PROVIDE 14,000 OFF-STREET CAR STALLS

| Structures | Type of Parking Structure: Parking Lot* | Parking Garage**: 3-Level | 4-Level | 5-Level | Underground # |
|---|---|---|---|---|---|
| Car Stalls per Structure | 100 | 290 | 390 | 490 | 500 |
| Number of Structures Required | 140 | 48 | 36 | 29 | 28 |
| Cost per Structure | $ 6,200 | $ 176,000 | $ 251,000 | $ 326,000 | $ 1,297,000 |
| Total Structure Cost for 14,000 Car Capacity | 868,000 | 8,500,000 | 9,000,000 | 9,450,000 | 36,300,000 |
| **Property** | | | | | |
| Based on Property at: | | | | | |
| $10 per Square Foot | $28,000,000 | $ 9,600,000 | $ 7,200,00 | $ 5,800,000 | $11,200,000 |
| $15 per Square Foot | 42,000,000 | 14,400,000 | 10,800,000 | 8,700,000 | 16,800,000 |
| $20 per Square Foot | 56,000,000 | 19,200,000 | 14,400,000 | 11,600,000 | 22,400,000 |
| **Total Cost** | | | | | |
| Based on Property at: | | | | | |
| $10 per Square Foot | 28,868,000 | 18,100,000 | 16,200,000 | 15,250,000 | 47,500,000 |
| $15 per Square Foot | 42,868,000 | 22,900,000 | 19,800,000 | 18,150,000 | 53,100,000 |
| $20 per Square Foot | 56,868,000 | 27,700,000 | 23,400,000 | 21,050,000 | 58,700,000 |
| **Total Cost per Car Stall** | | | | | |
| Based on Property at: | | | | | |
| $10 per Square Foot | 2,060 | 1,290 | 1,150 | 1,090 | 3,400 |
| $15 per Square Foot | 3,060 | 1,630 | 1,410 | 1,300 | 3,800 |
| $20 per Square Foot | 4,060 | 1,930 | 1,670 | 1,500 | 4,200 |

*-Based on 200 square feet per car space.
**-Based on garage 100' x 200'
#-Estimated for 3-level facility - 200' x 200'

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